Doyle Curry

FIELD AND DEPOT MAINTENANCE MANUAL

RADIO RECEIVER R-392/URR

BY ORDER OF THE SECRETARIES OF THE ARMY AND THE AIR FORCE:

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NG: State AG (3); Units—Same as Active Army except allowance is one copy for each unit.
USAR: None.
For explanation of abbreviations used, see AR 320–50.

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REFERENCES

TA 11-17	Signal Field Maintenance Shops.
TA 11-100 (11-17)	Allowances of Signal Corps Expendable Supplies for Signal Field Maintenance Shops.
TB SIG 319	Electronic Equipment Maintenance Kit MK-288/URM.
TM 11-2684	Audio Oscillators TS-312/FSM-1, TS-312A/FSM-1, and TS-382/U, and Signal Generator TS-312B/ FSM-1.
TM 11-2684A	Audio Oscillators TS-382A/U, TS-382B/U, TS-382D/U, and TS-382E/U.
TM 11-5017	Output Meters TS-585A/U, TS-585B/U, TS-585C/U, and TS-585D/U.
TM 11-5097	Spectrum Analyzers TS-723A/U and TS-723/U.
TM 11-5111	Power Supplies PP-1097A/G and PP-1097B/G.
TM 11-5126	Power Supply PP-1104A/G.
TM 11-5129	Oscilloscope AN/USM-50A, B, and C.
TM 11-5132	Voltmeter, Meter ME-30A/U and Voltmeters, Electronic ME-30B/U and ME-30C/U.
TM 11-5527	Multimeters TS-352/U, TS-352A/U, and TS-352B/U.
TM 11-5551	Instruction Book for Rf Signal Generator Set AN/URM-25.
TM 11-5551E	R. F. Signal Generator AN/URM-25F.
TM 11-5820-334-10	Operator's Manual: Radio Receiver R-392/URR.
TM 11-5820-334-20	Organizational Maintenance Manual: Radio Receiver R-392/URR.
TM 11-5820-334-20P	Organizational Maintenance Repair Parts and Special Tool List and Maintenance Allocation Chart: Receiver, Radio R-392/URR.
TM 11-5820-334-35P	Field and Depot Maintenance Repair Parts and Special Tools List: Receiver, Radio R-392/URR.
TM 11-6625-200-12	Operation and Organizational Maintenance: Multimeter ME-26B/U.
TM 11-6625-274-12	Operator's and Organizational Maintenance Manual: Test Sets, Electron Tube TV-7/U, TV-7A/U, TV-7B/U, and TV-7D/U.

3. Summary of Performance Standards

Personnel may find it convenient to arrange data in a manner similar to that shown below.

	Performance Standard
1. AM SENSITIVITY	
a. 0.5-0.999 mc	9 uv or less
b. 1.0-1.999 mc	7 uv or less
c. 2.0-2.999 mc	10 uv or less
d. 3.0-4.999 mc	9 uv or less
e. 5.0-8.999 mc	6 uv or less
f. 9.0-32 mc	5 uv or less
2. CW SENSITIVITY	
a. 0.5-0.999 mc	4 uv or less
b. 1.0-2.0 mc	3 uv or less
c. 2.0-32.0 mc	2 uv or less
3. IF OUTPUT	24 millivolts minimum
4. SELECTIVITY	
a. BAND WIDTH switch in 8 KC position	
(1) 3 db down	6.8-9.2 kc
(2) 6 db down	11.6 kc or less
b. BAND WIDTH switch in 2 KC position	
(1) 3 db down	2.0 kc or less
(2) 6 db down	2.5 kc or less
5. AUDIO POWER OUTPUT 200 mw minimum (10 uv input modulated 30% at 400 cycles)	
6. OVERALL AUDIO RESPONSE	
a. 300-2,500 cycles	+1 db -3
b. 3,500 cycles	-5 db or more
c. 5,000 cycles	-10 db or more
7. DISTORTION (OVERALL) (1,000 uv input, modulated 30% at 400 cycles)	10% or less
8. SQUELCH THRESHOLD	
a. Squelch opens (diode load voltage)	2.8 volts or less
b. Squelch closes (diode load voltage)	0.8 volts or more

102. Operational Tests
(fig. 75)

a. *Test Equipment and Materials.*

Electrical Special Purpose Power Cable Assembly CX-1597/U or equivalent.
Dynamic Loudspeaker LS-166/U.
Test transmitter (not required if a signal from a commercial or government radio station can be received).

b. *Test Connections and/or Conditions.* Connect the equipment as shown in figure 75. A transmitted signal, amplitude modulated, in the frequency range of 0.5 to 32 megacycles is required for this test. The signal from a nearby commercial or government radio station may be used, or a test transmitter meeting the requirements may be set up.

c. *Procedure.*

Step No.	Test equipment control settings	Radio Receiver R-392/URR control settings	Test procedure	Performance standard
1	None.	MEGACYCLES: 05. KILOCYCLES: 000. BAND WIDTH: 8 KC. BFO: OFF. AGC: ON. Function switch: OFF. RF GAIN SQUELCH THRESH: fully clockwise. AF GAIN: midposition. DIAL DIM: OFF.	*a.* Set the receiver function switch to STAND BY, observe the receiver vacuum tubes, and note any sound coming from the loudspeaker. *b.* Turn the DIAL DIM switch knob to the ON position and then to the midposition. *c.* Set the function switch to NORMAL. *d.* While observing the armature of antenna relay K101 (fig. 75), set the AGC switch knob to CAL.	*a.* The vacuum tube filaments light but there is no sound from the loudspeaker. *b.* The frequency indicator dial lights brightly with the switch in the ON position, and at reduced brilliance with the switch in the midposition. *c.* A hissing noise is heard coming from the loudspeaker. *d.* The relay operates as the AGC switch knob is turned to the CAL position.
2	None.	MEGACYCLES: 05. KILOCYCLES: 000. B AND WIDTH: 2 KC. Function switch: NORMAL. BFO: ON. BFO PITCH: 0. AGC: CAL. RF GAIN SQUELCH THRESH: fully clockwise. AF GAIN: midposition.	*a.* Set the KILOCYCLES dial at exactly zero (000). *b.* Turn the DIAL ZERO control fully clockwise and tighten fingertight. *c.* Adjust the KILOCYCLES control carefully for a zero-beat indication in the loudspeaker. *d.* Turn the DIAL ZERO control fully counterclockwise. *Note.* If there is a change in the zero-beat condition, repeat the procedures in *a* through *d* above.	Calibration is possible (zero dial indication (000) coincidental with zero-beat condition) with use of the applicable procedure.
3	None.	BAND WIDTH: 8 KC. Function switch: NORMAL. BFO: OFF. AGC: ON. RF GAIN SQUELCH THRESH: fully clockwise. AF GAIN: midposition.	*a.* Tune the receiver to the frequency of the transmitted test signal and note the quality of the received signal. *b.* With the receiver in operation, tap the various chassis gently with a padded mallet or similar object to simulate vibration and note any evidence of intermittents or microphonic conditions. *c.* Turn off and disconnect the equipment. Replace the receiver in its case.	*a.* The receiver signal is clear and intelligible. *b.* There is no intermittent operation or microphonics when the receiver is subjected to shock and vibration. *c.* None.

95. Physical Tests and Inspection

a. Test Equipment and Materials. None.

b. Test Connections and Conditions. The receiver must be removed from its case for this and all subsequent tests.

c. Procedure.

Step No.	Test equipment control settings	Radio Receiver R–392/URR control settings	Test procedure	Performance standard
1	None.	Controls may be in any position.	*a.* Inspect the receiver for loose and missing parts, physical damage, and condition of finish. *Note.* Touchup painting is recommended in lieu of refinishing whenever practicable. Screwheads, receptacles, and other plated parts will not be painted or polished with abrasives.	*a.* No loose or missing parts or physical damage evident. All surfaces intended to be painted do not show bare metal. Panel lettering legible.
			b. Inspect all connectors, plugs, and receptacles for looseness and damage.	*b.* All plugs and connectors are tight. All receptacles are tight and free from damage.
			c. Remove the fuseholder caps; inspect the fuseholders for damage and the fuses for correct type and rating. *Note.* Replace the fuseholder caps before proceeding.	*c.* The fuseholders are in serviceable condition. Each fuseholder contains a good fuse of the proper type and rating, as indicated on the panel above the fuseholder.
2	None.	Set controls as indicated in *Test procedure* column.	*a.* Turn the MEGACYCLES control fully counterclockwise; note the action of the mechanism and the final indication on the MEGACYCLES dial.	*a.* The control turns freely without binding or excessive looseness. The detent function is positive and synchronized with the dial. The MEGACYCLES dial indicates halfway between 00 and 99, with the control at the counterclockwise stop.
			b. Turn the MEGACYCLES control fully clockwise; note the action of the mechanism and the final indication on the MEGACYCLES dial.	*b.* The control turns freely without binding or excessive looseness. The detent function is positive and synchronized with the dial. The MEGACYCLES dial indicates halfway between 31 and 32, with the control at the clockwise stop.
			c. Turn the DIAL LOCK control counterclockwise.	*c.* The DIAL LOCK control turns freely without binding or excessive looseness.
			d. Turn the DIAL LOCK control fully counterclockwise.	*d.* The DIAL ZERO control turns freely without binding or excessive looseness.
			e. Turn the KILOCYCLES control fully clockwise; note the KILOCYCLES dial indication.	*e.* The control turns freely without binding or excessive looseness. The KILOCYCLES dial indicates between +015 and +035 (note plus sign).
			f. Turn the KILOCYCLES control fully counterclockwise; note the KILOCYCLES dial indication.	*f.* The control turns freely without binding or excessive looseness. The KILOCYCLES dial indicates between -985 and -965 (note minus sign).
			g. Turn each of the following front panel controls throughout their limits of travel: (1) AF GAIN. (2) BFO PITCH. (3) RF GAIN SQUELCH THRESH. (4) ANT TRIM.	*g.* The controls turn freely without binding or excessive looseness. Knobs are tight on their shafts and properly indexed.
			h. Turn each of the following front panel switches to each of their indicated positions: (1) DIAL DIM. (2) BAND WIDTH. (3) Function switch. (4) BFO. (5) AGC.	*h.* The switches operate freely without binding or excessive looseness. The detent function is positive. Knobs are tight on their shafts and properly indexed.
			i. Turn the DIAL LOCK control fully clockwise (fingertight); then attempt to turn the KILOCYCLES control. ***Caution:*** **Do not exert undue force in attempting to turn the KILOCYCLES control.** *Note.* Turn the DIAL LOCK control fully counterclockwise before proceeding	*i.* The KILOCYCLES control is firmly locked.
			j. Note the indication on the CARRIER LEVEL	*j.* The pointer of the CARRIER LEVEL meter lies directly

pecial Test Facilities

Because of the sensitivity of the re-
r and its construction, the electrical
(except the operational tests (para
should be conducted in a well-
ded room. Electromagnetic Shielding
osure MX-1761/G, listed in the chart
aragraph 93*a*, or its equivalent, is
ble.

A primary source of dc power capable
pplying 3 amperes at 28 volts is re-
d to power the receiver for the tests.
power source output voltage must be
from any fluctuations or interference;
fore, no other equipment should be
ted from the power source used to power the receiver during the tests. Either of the power supplies listed in the chart in paragraph 93*b* or any other available source of power meeting the requirements may be used.

c. A special-purpose cable assembly is required to connect Radio Receiver R-392/URR to a power source. Electrical Special Purpose Cable Assembly CX-1597/U, designed for this purpose, may be used if available, or a suitable cable assembly may be fabricated by use of the connector and electrical power cable (or equivalent) listed in the chart in paragraph 93*b*. A wiring diagram of the power cable assembly is given in figure 68.

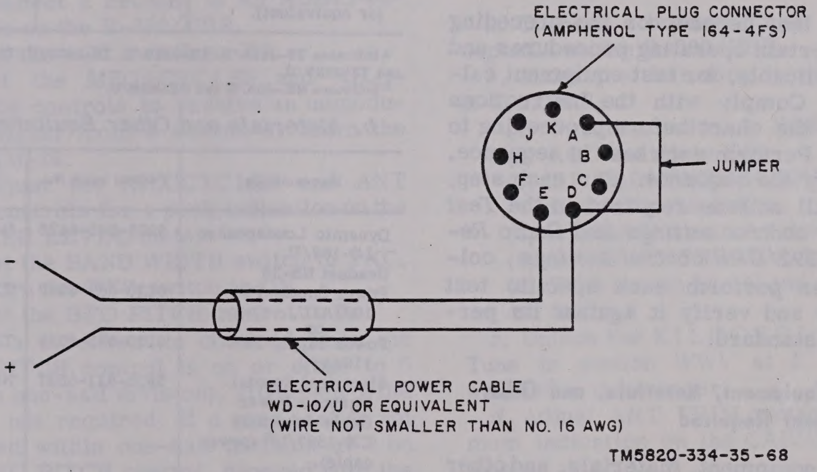


Figure 68. Power cable assembly wiring diagram.

CHAPTER 4

FOURTH ECHELON TESTING PROCEDURES

92. General

a. Testing procedures are prepared for use by Signal Field Maintenance Shops and Signal Service Organizations responsible for fourth echelon maintenance to determine the acceptability of repaired signal equipment. These procedures prescribe specific requirements that repaired signal equipment *must* meet before it is returned to the using organization. The procedures may also be used as a guide for testing equipment repaired at third echelon if the proper tools and test equipment are available. A summary of the performance standards is given in paragraph 103.

b. Each test depends on the preceding one for certain operating procedures and where applicable, for test equipment calibrations. Comply with the instructions preceding the chart before proceeding to the chart. Perform each test in sequence. *Do not vary the sequence.* For each step, perform all actions required in the *Test equipment control settings* and *Radio Receiver R-392/URR control settings* columns; then perform each specific test procedure and verify it against its performance standard.

93. Test Equipment, Materials, and Other Equipment Required

All test equipment, materials, and other equipment required to perform the tests given in this section are listed in the following charts and are authorized under TA 11-17 and TA 11-100(11-17) except as noted. Specific models of equipment are used to perform the test procedures given in paragraphs 95 through 101. If these test procedures are performed with other models of equipment, an allowance must be made for any test connection or test results that may differ from those given in these test procedures.

a. Test Equipment.

Nomenclature	Federal stock No.	Technical man
RF Signal Generator AN/URM-25F.	6625-570-5719	TM 11-555
Output Meter TS-585B/U.	6625-244-0501	TM 11-501
Electronic Multimeter TS-505A/U.	6625-243-0562	TM 11-551
Audio Oscillator TS-382 (*)/U[a].	6625-192-5094	TM 11-268
Spectrum Analyzer TS-723A/U.	6625-668-9418	TM 11-509
Electronic Equipment Maintenance Kit MK-288/URM.	6625-557-5716	TB SIG 319
Electronic Voltmeter ME-30(*)/U[b].	6625-669-0742	TM 11-513
Electromagnetic Shielding Enclosure MX-1761/G (or equivalent).	4940-542-0002	None

[a] Indicates TS-382A/U, TS-382B/U, TS-382D/U, TS-382E/U and TS-382F/U.

[b] Indicates ME-30A/U and ME-30B/U.

b. Materials and Other Equipment.

Nomenclature	Federal stock No.	Technical reference
Dynamic Loudspeaker LS-166/U.	5965-243-6420	None
Headset HS-30		
Power Supply PP-1097A/U.	6130-669-6640	TM 11-511
or		
Power Supply PP-1104A/U.	6130-542-6385	TM 11-512
Electrical Special Purpose Power Cable Assembly CX-1597/U[a] (power cable).	5935-511-6537	None
or both		
Electrical plug connector[b].	5935-511-6537	None
and		
Electrical Power Cable WD-10/U[c].	6145-284-0087	TA 11-100 (11-17)
Telephone Plug PJ-055B.	5935-192-4760	None
Electrical wire (hook-up wire 12")[d].	6145-160-5291	None

[a] Used to connect Radio Receiver R-392/URR to a power source but not authorized under TA 11-100(11-17).

[b] Repair part item for Radio Set AN/GRC-19 authorized stockage at third through fifth echelon. Required to fabricate power cable if Electrical Special Purpose Power Cable Assembly CX-1597/U is not available.

[c] Required to fabricate power cable if Electrical Special Purpose Power Cable Assembly CX-1597/U in not available.

[d] Any insulated, stranded, copper conductor, hookup wire; #20 AWG is suitable.

Rf stage alignment

1	2	3	4	5	6	7
Set of rf coils	MEGACYCLES control setting	KILOCYCLES control setting	Signal generator frequency (tune for peak output) kc	Adjust slugs for peak output.	Adjust trimmer capacitors for peak output	Signal generator connection (preliminary alignment only)
8-16 mc	08	800	8,800	L219 L212 L236 L239		Pin 1, V202; pin 1, V201; ANT post E101
	15	200	15,200		C261 C239 C317 C319	Pin 1, V202; pin 1, V201; ANT post E101
16-32 mc	17	600	17,600	L220 L213 L206		Pin 1, V202; pin 1, V201; ANT post E101
	30	400	30,400		C264 C242 C219	Pin 1, V202; pin 1, V201; ANT post E101

0. Calibration of Bfo

a. Connect a headset to an AUDIO re-
eptacle on the R-392/URR.

b. Set the AGC switch to ON.

c. Set the MEGACYCLES and KILO-
YCLES controls to receive an unmodu-
ted signal from a station or from the
N/URM-25.

d. Adjust the KILOCYCLES and ANT
RIM controls for a peak indication on the
ARRIER LEVEL meter.

e. Set the BAND WIDTH switch to 2 KC.

f. Turn the BFO switch to ON.

g. Set the BFO PITCH control to 0.

h. If a zero beat is obtained when the
FO PITCH control is on or close to 0
vithin one-half division), alignment of the
fo is not required. If a zero beat is not
btained within one-half division of 0 on
e BFO PITCH control, proceed with the
lignment as follows:

(1) Remove the lower deck assembly from the receiver (para 62). Connect plugs P113 to J613, P810 to J510, P112 to J612, and P111 to J611 (fig. 53). *Do not use extension cables.*

(2) Tune the receiver as described in *b* through *g* above.

(3) Adjust the slug of T602 (fig. 40) to obtain a zero beat with the BFO PITCH control at 0.

(4) Reassemble the lower deck assembly (para 62).

91. Adjustment of Calibration Oscillator

a. Connect a headset to an AUDIO receptacle on the R-392/URR.

b. Make the following settings on the R-392/URR:

(1) Function switch to NORMAL.

(2) AGC switch to ON.

(3) RF GAIN THRESH SQUELCH control fully clockwise.

(4) AF GAIN control fully clockwise.

(5) BAND WIDTH switch to 2 KC.

(6) BFO switch to ON and BFO PITCH to 0.

c. Unlock the KILOCYCLES control Tune in station WWV at 5, or 10 mc, whichever is stronger.

d. Adjust ANT TRIM control for maximum indication on the CARRIER LEVEL meter.

e. Adjust the KILOCYCLES control for a zero beat. Make this adjustment when WWV is unmodulated to avoid a zero beat with a sideband.

f. If the last three digits on the frequency indicator dial are not exactly 000, turn the DIAL ZERO control completely clockwise and adjust the KILOCYCLES control for an exact 000.

g. Set the AGC switch to CAL. No beat note should be heard. If a beat note is heard, adjust trimmer capacitor C706 (fig. 50) for a zero beat. *Do not turn the BFO PITCH control during this adjustment.*

(5) AGC switch to OFF.

(6) ANT TRIM control to 0.

c. Connect the AN/URM-25 through a 50-uuf capacitor to points in the order listed in column 7 of the chart in *i* below.

d. Set the MEGACYCLES and KILOCYCLES controls to indicate (on the frequency indicator) the digits in columns 2 and 3, respectively.

e. Set the AN/URM-25 to the frequency listed in column 4. To obtain the exact required frequency, adjust the AN/URM-25 tuning control for a peak indication on the ME-26/U. Do not depend upon the calibration of the AN/URM-25.

f. During the procedure, adjust the AN/URM-25 attenuator to maintain an indication of less than 3 volts on the ME-26/U.

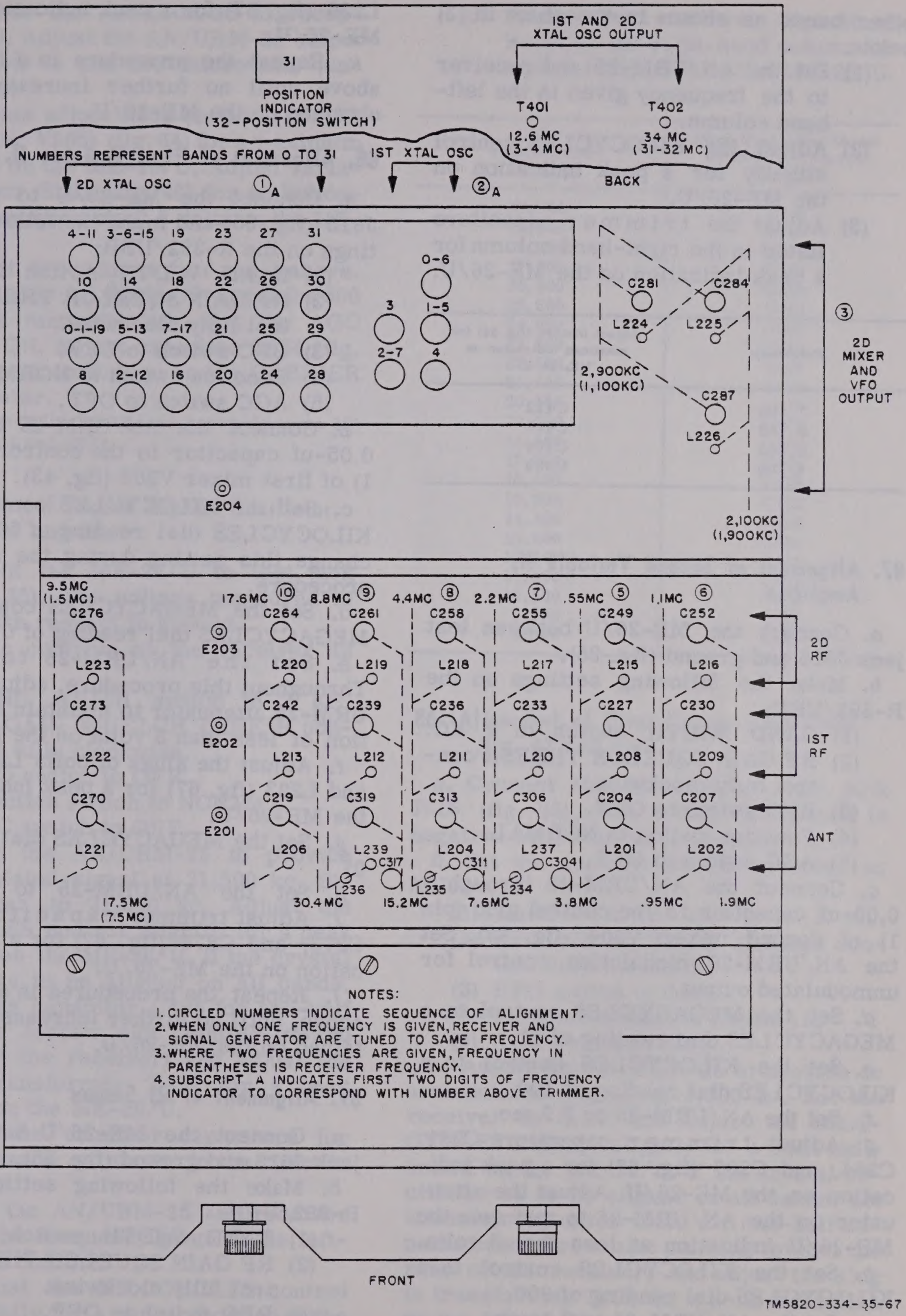
g. Refer to figure 67 for location of rf adjustment screws. Adjust the slugs for a set of tuned circuits while the receiver is tuned to the lower frequency indicated in the chart for that set of tuned circuits. Adjust the trimmer capacitors while the receiver is tuned to the higher frequency. Adjust the slugs of a set of tuned circuits listed in column 5 to obtain a peak indication on the ME-26/U. After changing the frequency settings of the receiver and the AN/URM-25, adjust the trimmer capacitors of a set of tuned circuits listed in column 6 to obtain a peak indication on the ME-26/U. The trimmer capacitors are accessible through holes in the top of the shield cans; they are adjusted by using the insulated alignment tool.

h. Repeat adjustments for each set of rf coils until no further change is noticeable on the ME-26/U.

i. The alignment of rf stages is shown in the chart below.

Rf stage alignment

1	2	3	4	5	6	7
Set of rf coils	MEGACYCLES control setting	KILOCYCLES control setting	Signal generator frequency (tune for peak output) kc	Adjust slugs for peak output.	Adjust trimmer capacitors for peak output	Signal generator connection (preliminary alignment only)
0.5-1 mc	00	550	550	L215 L208 L201		Pin 1, V202; pin 1, V201; ANT post E101
	00	950	950		C249 C227 C204	Pin 1, V202; pin 1, V201; ANT post E101
1-2 mc	01	100	1,100	L216 L209 L202		Pin 1, V202; pin 1, V201; ANT post E101
	01	900	1,900		C252 C230 C207	Pin 1, V201; pin 1, V201; ANT post E101
2-4 mc	02	200	2,200	L217 L210 L234 L237		Pin 1, V202; pin 1, V201; ANT post E101
	03	800	3,800		C255 C233 C304 C306	Pin 1, V202; pin 1, V201; ANT post E101
4-8 mc	04	400	4,400	L218 L211 L235 L238		Pin 1, V202; pin 1, V201; ANT post E101
	07	600	7,600		C258 C236 C311 C313	Pin 1, V202; pin 1, V201; ANT post E101



NOTES:

1. CIRCLED NUMBERS INDICATE SEQUENCE OF ALIGNMENT.
2. WHEN ONLY ONE FREQUENCY IS GIVEN, RECEIVER AND SIGNAL GENERATOR ARE TUNED TO SAME FREQUENCY.
3. WHERE TWO FREQUENCIES ARE GIVEN, FREQUENCY IN PARENTHESES IS RECEIVER FREQUENCY.
4. SUBSCRIPT A INDICATES FIRST TWO DIGITS OF FREQUENCY INDICATOR TO CORRESPOND WITH NUMBER ABOVE TRIMMER.

Figure 67. Receiver upper deck, alignment points.

other bands as shown in the chart in (3) below.

(1) Set the AN/URM-25 and receiver to the frequency given in the left-hand column.
(2) Adjust the KILOCYCLES control slightly for a peak indication on the ME-26/U.
(3) Adjust the trimmer capacitors listed in the right-hand column for a peak indication on the ME-26/U.

Frequency	Adjust trimmer (fig. 65) for maximum indication on ME-26/U
7,500	C412
6,500	C410
5,500	C404
4,500	C408

87. Alignment of Second Variable If. Amplifier

a. Connect the ME-26/U between test jack J615 and ground (fig. 35).

b. Make the following settings on the R-392/URR:

(1) BAND WIDTH switch to 2 KC.
(2) RF GAIN SQUELCH THRESH control fully clockwise.
(3) BFO switch to OFF.
(4) Function switch to NORMAL.
(5) AGC switch to OFF.

c. Connect the AN/URM-25 through a 0.05-uf capacitor to the control grid (pin 1) of second mixer V204 (fig. 43). Set the AN/URM-25 modulation control for unmodulated output.

d. Set the MEGACYCLES control to a MEGACYCLES dial reading of 01.

e. Set the KILOCYCLES control to a KILOCYCLES dial reading of 100.

f. Set the AN/URM-25 to 2.9 mc.

g. Adjust trimmer capacitors C281, C284, and C287 (fig. 67) for a peak indication on the ME-26/U. Adjust the attenuator on the AN/URM-25 to maintain the ME-26/U indication at less than 3 volts.

h. Set the KILOCYCLES control to a KILOCYCLES dial reading of 900.

i. Set the AN/URM-25 to 2.1 mc.

j. Adjust the slugs of L224, L225, and L226 (fig. 67) for a peak indication on the ME-26/U.

k. Repeat the procedure in *d* through *j* above until no further increase can be obtained on the ME-26/U.

88. Alignment of First Variable If. Amplifier

a. Connect the ME-26/U to test jack J615 (fig. 35) and make the following settings on the R-392/URR:

(1) BAND WIDTH switch to 2 KC.
(2) RF GAIN SQUELCH THRESH control fully clockwise.
(3) BFO switch to OFF.
(4) Function switch to NORMAL.
(5) AGC switch to OFF.

b. Connect the AN/URM-25 through a 0.05-uf capacitor to the control grid (pin 1) of first mixer V203 (fig. 43).

c. Set the KILOCYCLES control for a KILOCYCLES dial reading of 500. Do not change this setting during the alignment procedure.

d. Set the MEGACYCLES control for a MEGACYCLES dial reading of 01.

e. Set the AN/URM-25 to 9.5 mc. Throughout this procedure, adjust the AN/URM-25 attenuator to maintain an indication of less than 3 volts on the ME-26/U.

f. Adjust the slugs of coils L221, L222, and L223 (fig. 67) for a peak indication on the ME-26/U.

g. Set the MEGACYCLES dial reading to 07.

h. Set the AN/URM-25 to 17.5 mc.

i. Adjust trimmer capacitors C270, C273, and C276 (fig. 67) for a peak indication on the ME-26/U.

j. Repeat the procedures in *d* through *i* above, until no further increase can be obtained on the ME-26/U.

89. Alignment of Rf Stages

a. Connect the ME-26/U between test jack J615 and ground (fig. 35).

b. Make the following settings on the R-392/URR:

(1) BAND WIDTH switch to 2 KC.
(2) RF GAIN SQUELCH THRESH control fully clockwise.
(3) BFO switch to OFF.
(4) Function switch to NORMAL.

h. Connect the AN/URM-25 to recep-
cle J510. Adjust the AN/URM-25 output
r between 75 and 100 microvolts (un-
odulated).

i. Set bias adjust R532 (cathode of fifth
amplifier V505) (fig. 64) for a maximum
dication on the ME-26/U. Adjust varia-
e resistor R521 (fig. 40) for an indica-
on of approximately 2.5 volts on the ME-
/U.

j. Repeat procedures in *f* and *g* above.

k. Adjust the AN/URM-25 output for 300
icrovolts (unmodulated). Set the AGC
vitch at ON. Adjust capacitor C634 (fig.
) for a peak indication on the CARRIER
EVEL meter.

Vote. Remove the lower deck assembly (para 62)
adjust C634 and R521.

. Alignment of Second Crystal Oscillator
(fig. 47 and 64)

a. Connect the ME-26/U to test jack
15 (fig. 35). The voltage measured is
gative with respect to ground.

b. Set the controls on the receiver as
llows:

(1) BAND WIDTH switch to 2 KC.
(2) RF GAIN SQUELCH THRESH control fully clockwise.
(3) BFO switch to OFF.
(4) Function switch to NORMAL.
(5) AGC switch to OFF.

c. Adjust the AN/URM-25 to provide
unmodulated signal at 31,500 kc. Set
e receiver to 31,500 kc. Adjust the
LOCYCLES control slightly for a peak
dication on the ME-26/U. If the crystal
cillator is to be aligned on all bands,
t trimmer capacitor C435 for one-half
pacitance (screw slot pointing toward
e rear of the receiver) and adjust the
ug of transformer T402 for a peak
dication on the ME-26/U.

d. Align the trimmer capacitors for
e other bands as shown in the chart in
) below.

(1) Set the AN/URM-25 and receiver to the frequency given in the left-hand column.
(2) Adjust the KILOCYCLES control slightly for a peak indication on the ME-26/U.
(3) Adjust the trimmer capacitors listed in the right-hand column for a peak indication on the ME-26/U.

Frequency (kc)	Adjust trimmer (fig. 65) for maximum indication on ME-26/U
30,500	C436
29,500	C437
28,500	C438
27,500	C439
26,500	C440
25,500	C441
24,500	C442
23,500	C444
22,500	C446
21,500	C448
20,500	C450
19,500	C452
18,500	C454
17,500	C424
16,500	C456
15,500	C422
14,500	C432
13,500	C430
12,500	C418
11,500	C420
10,500	C428
9,500	C416
8,500	C426

86. Alignment of First Crystal Oscillator
(fig. 47 and 64)

a. Connect the ME-26/U to test jack J615 (fig. 35). The voltage measured is negative with respect to ground.

b. Set the controls on the receiver as follows:

(1) BAND WIDTH switch to 2 KC.
(2) RF GAIN SQUELCH THRESH control fully clockwise.
(3) BFO switch to OFF.
(4) Function switch to NORMAL.
(5) AGC switch to OFF.

c. Adjust the AN/URM-25 to provide an unmodulated signal at 3,500 kc. Set the receiver to 3,500 kc. Adjust the KILOCYCLES control slightly for a peak indication on the ME-26/U. If the crystal oscillator is to be aligned on all bands, set trimmer capacitor C406 for one-half capacitance (screw slot pointing toward the rear of the receiver) and adjust the slug in transformer T401 for a peak indication on the ME-26/U.

d. Align the trimmer capacitors for the

83. Carrier Level Meter Adjustment

Note. If CARRIER LEVEL meter zero potentiometer R622 is improperly adjusted, serious reduction in gain may result.

a. Disconnect the antenna from the receiver input.

b. Set the AGC switch to ON.

c. Set the RF GAIN SQUELCH THRESH control fully clockwise.

d. Adjust meter zero potentiometer R622 (fig. 35) on the lower deck assembly to obtain a zero reading on the CARRIER LEVEL meter.

84. Alignment of 455-Kc If. Stages

a. Allow at least a 5-minute warmup time for the receiver and the AN/URM-25.

b. Connect the AN/URM-25 output lead through a 0.05-uf capacitor to J510 or pin 5 of vfo-mixer V801 (fig. 41). Set the AN/URM-25 modulation control for unmodulated output. To avoid removing a subchassis when a voltage is to be measured or when a signal is to be injected at a tube socket pin that does not have a test point, remove the tube, wrap 1 turn of a short, thin, insulated wire, with both ends bared, around the desired pin, and replace the tube. Connection for measurement or signal injection can then be made through the exposed end of the wire.

c. Connect the ME-26/U to test jack J615 (fig. 35). The voltage measured is developed across diode-load resistor R605 and is negative with respect to ground.

d. Make the following settings on the R-392/URR:

(1) BAND WIDTH switch to 2 KC.
(2) RF GAIN SQUELCH THRESH control fully clockwise.
(3) BFO switch to OFF.
(4) Function switch to NORMAL.
(5) AGC switch to OFF.

e. Set the AN/URM-25 frequency to 455 kc and advance its signal output until an indication is obtained on the ME-26/U. Perform the adjustments described in *f* below. If no indication is obtained, perform the following steps to obtain an approximate alignment before proceeding:

(1) Set the AN/URM-25 to 455 kc at maximum output. Turn the BAND WIDTH switch to 8 KC. If outpu is not yet obtained, perform th procedure outlined in (2) below If output indication is obtainec adjust the slugs of transformer T505, T504, T503, T502, and T50 (fig. 39), in that order, for a pea indication on the ME-26/U. Set th BAND WIDTH switch to 4 KC, an readjust the slugs for peak output Repeat the adjustments with th BAND WIDTH switch at 2 KC After completing the adjustments perform the procedure describe in *f* below.

(2) The following procedure is required when the slugs have bee displaced too far from their norma positions within the transformers

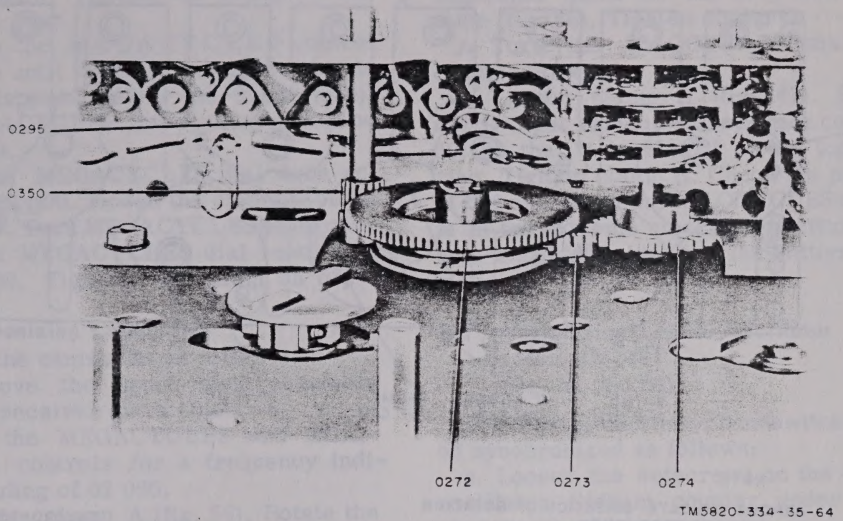
(a) Set the BAND WIDTH switch a 2 KC and the AN/URM-25 to 45 kc. Connect the AN/URM-25 output to pin 1 of tube V505. Adjus the slugs of transformer T50 for peak output.

(b) Apply the 455-kc signal to pi 1 of tube V504, and adjust th slugs of transformer T504 fo peak output.

(c) Apply the procedure describe in (*a*) and (*b*) above to remaining tubes and transformers, i the following order: tube V503 transformer T503; tube V502 transformer T502; tube V501 transformer T501. Proceed wit the next step in *f* below.

f. During alignment, continually adjus the attenuator of the AN/URM-25 to main tain the indication on the ME-26/U belo 3 volts. Connect the AN/URM-25 to pi 5 of V801 and adjust the slugs of trans formers T601 (fig. 35), T505, T504, T503 and T502 (fig. 39), in that order, for pea indication on the ME-26/U. Repeat thes adjustments until no further increase i output is noticeable on the ME-26/U

g. Turn the BAND WIDTH switch fro 2 KC to 8 KC. Adjust the slugs of trans former T501 for a peak indication on th ME-26/U. Repeat the adjustment of thes slugs until no further increase is notec



0272 Geneva system	0295 Shaft, crystal switch
0273 Gear, spur, 8-tooth	0350 Gear, spur, 16-tooth
0274 Gear, spur, 24-tooth	

Figure 66. Geneva system and overtravel coupler.

If, after checking the synchronization the frequency indicator (*a* above), the vement of bandswitch shaft 0295 does take place between the proper bands, ceed as follows with the synchronization of the Geneva system and overtravel pler:

(1) Turn the MEGACYCLES control counterclockwise until the stop is reached (below 00 mc).

(2) Loosen the clamp for gear 0347 (fig. 62).

(3) Turn shaft 0295 until the Geneva system and overtravel coupler 0272 reaches its stop in the clockwise (0272 viewed from rear of rf subchassis) direction.

(4) Tighten gear clamp 0347 (fig. 62).

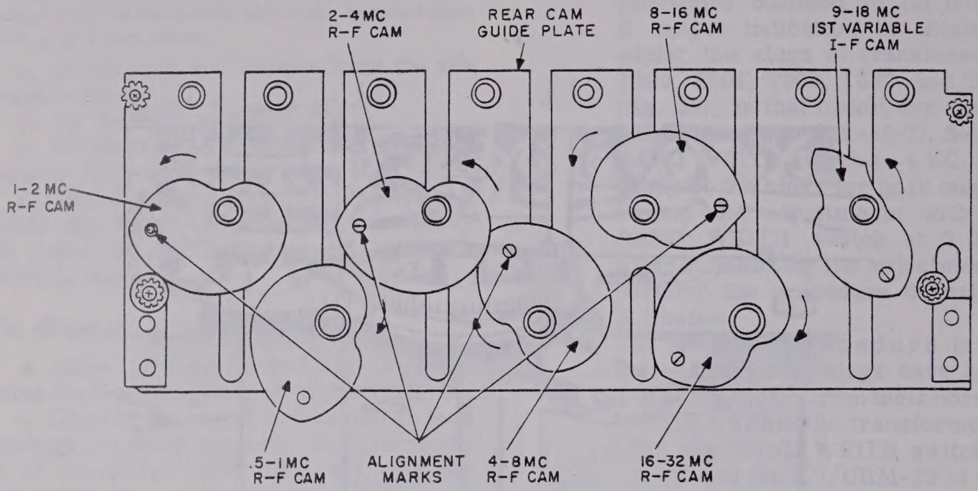
c. This adjustment may affect synchronization of crystal oscillator bandswitch S401 and rf bandswitch S201. Check the synchronization of these systems as given in paragraphs 74 and 80.

Section IV. ALIGNMENT

Test Equipment and Special Tools Required for Alignment

he following test equipment and special ls are required for alignment of Radio eiver R-392/URR.

Item	Technical manual
R. F. Signal Generator AN/URM-25	TM 11-5551
Multimeter, Meter ME-26/U	TM 11-6625-200-12
Alignment tool (insulated)	



NOTE:
ARROWS INDICATE DIRECTION OF ROTATION TO INCREASE FREQUENCY.

TM5820-334-35-62

Figure 65. Rf and if. cams, rear view (synchronized at 2 mc).

is heard in the headset. Adjust the KILOCYCLES control for maximum noise.

e. Note the reading of the last three digits on the frequency indicator dial.

f. Turn the AGC switch to CAL, and the BFO switch to ON. Set the BFO PITCH control to 0, and set the frequency indicator dial reading at the nearest 100-kc point to the reading noted in *e* above.

g. Adjust the vfo shaft slightly by hand until a zero beat is obtained. It should not be necessary to turn the vfo shaft more than 1 full turn in either direction to obtain a zero beat.

80. Checking and Synchronizing Six-Position Rf Bandswitch S201

(fig. 66)

Remove the upper deck assembly (para 63) and proceed as follows:

a. Set the MEGACYCLES control to a MEGACYCLES dial reading of 00.

b. Loosen the clamp on gear 0274 on the rf bandswitch shaft and turn the shaft to set the switch contacts so that the 0.5- to 1.0-mc coils are connected into the circuit as indicated by a continuity measurement between E201 and pin 3 of Z201 (fig. 43 and 44).

c. Tighten the clamp on gear 0274 on the rf bandswitch shaft.

d. Turn the MEGACYCLES control through its range. The rf bandswitch should move between 0 and 1, 1 and 2, 3 and 4, 7 and 8, and 15 and 16 mc. If the rf bandswitch does not move between the bands indicated, synchronization of the Geneva system and overtravel coupler (para 81) is necessary.

81. Checking and Synchronizing Geneva System and Overtravel Coupler

(fig. 66)

a. Turn the MEGACYCLES control through its range. The rf bandswitch shaft should turn between bands 0 and 1, 1 and 2, 3 and 4, 7 and 8, and 15 and 16 mc.

f. Turn the indicator dial drums to a EGACYCLES dial reading of slightly elow 00. The tips of the 99 should just art to show. Tighten the clamp on the al bevel gear.

g. Turn the MEGACYCLES control ockwise until the first detent position is eached (approximately one-fourth turn). he MEGACYCLES dial reading should be xactly 00.

h. If the MEGACYCLES dial does not ead exactly 00, loosen the clamp on bevel ear 0327. Turn MEGACYCLES bevel gear 37 to a MEGACYCLES dial reading of xactly 00. Tighten the clamp on 0327.

. Synchronizing Camshafts

Adjust the camshafts as follows:

a. Remove the upper deck assembly om the receiver (para 63).

b. Set the MEGACYCLES and KILO-YCLES controls for a frequency indi-tor reading of 02 000.

c. Loosen clamp A (fig. 59). Rotate the 5- to 1.0-mc rf cam until the hole in the ar cam is aligned with the alignment ark on the rear cam guide plate (fig.). Tighten clamp A.

d. Loosen clamp B (fig. 59). Rotate the 0- to 2.0-mc rf cam until the hole in the ar cam is aligned with the alignment ark on the rear cam guide plate (fig. 65). ghten clamp B.

e. Loosen clamp C (fig. 59). Rotate the 0- to 4.0-mc rf cam until the hole in the ar cam is aligned with the alignment ark on the rear cam guide plate (fig. 65). ghten clamp C.

f. Loosen clamp D (fig. 59). Rotate the 0- to 8.0-mc rf cam until the hole in the ar cam is aligned with the alignment ark on the rear cam guide plate (fig. 65). ghten clamp D.

g. Loosen clamp E (fig. 59). Rotate the 0- to 16.0-mc rf cam until the hole in e rear cam is aligned with the alignment ark on the rear cam guide plate (fig. 65). ghten clamp E.

h. Loosen clamp F (fig. 59). Rotate the .0- to 32.0-mc rf cam until the hole in e rear cam is aligned with the alignment ark on the rear cam guide plate (fig. 65). ghten clamp F.

i. Loosen clamp G (fig. 59). Rotate the 9- to 18-mc first variable if. cam until the hole in the rear cam is aligned with the alignment mark on the rear cam guide plate (fig. 65). Tighten clamp G.

j. Turn the KILOCYCLES dial fully counterclockwise.

k. Loosen clamp H (fig. 61). Set the small (first variable if.) can rack cam (fig. 60) so that it is almost at the top of its rise. Tighten clamp H. Check the position of the cam when the KILOCYCLES control is at the extreme clockwise position. The cam should be almost at the bottom of its rise.

78. Synchronizing Crystal Oscillator Bandswitch S401

(fig. 57 and 64)

The crystal oscillator bandswitch should be synchronized as follows:

a. Loosen the setscrews on the crystal oscillator Oldham coupler under the rf chassis (fig. 57).

b. Set the MEGACYCLES control to a MEGACYCLES dial reading of 00.

c. Turn the crystal oscillator switch adjust shaft (screwdriver adjustment) at the rear of the crystal unit (fig. 64) and set the drum dial of the position indicator to zero.

d. Tighten the setscrew on the crystal oscillator Oldham coupler (fig. 57).

79. Synchronizing Vfo Tuning Shaft

(fig. 53)

Synchronize the vfo tuning shaft as follows:

a. Turn on the receiver and allow it sufficient time to warm up.

b. Loosen the clamp on the side of the Oldham coupler that is closest to the front panel so that the vfo tuning shaft may turn freely.

c. Set the receiver controls for normal voice reception and connect a headset to AUDIO receptacle J101 or J102.

d. With the first two digits of the frequency indicator dial at any setting, slowly rotate the KILOCYCLES control clockwise, starting from its lowest frequency setting, until a rush of background noise the numbers are different, proceed to paragraph 75.

75. Checking Vfo Against Frequency Indicator Dial

Check the vfo against the frequency indicator dial as follows:

a. Turn the KILOCYCLES control to obtain a KILOCYCLES dial reading of 500. The MEGACYCLES dial can be set to any reading.

b. Connect an antenna to a calibrated receiver and bring the antenna near the vfo tube of the receiver under test.

c. Turn the VFO switch of the calibrated receiver to ON and set the BFO PITCH control to 0.

d. Set the calibrated receiver frequency indicator dial to 2.955 kc. Adjust the KILOCYCLES control of the calibrated receiver to obtain a zero beat with the receiver under test.

e. If a zero beat is not obtained with slight adjustment of the KILOCYCLES control of the calibrated receiver, procee to paragraph 79.

76. Synchronizing Frequency Indicator Dial with MEGACYCLES and KILOCYCLES Control Shaft Stops

(fig. 56)

Adjust the frequency indicator dial wit the control shaft stops as follows:

a. Loosen the clamp on KILOCYCLE frequency indicator dial bevel gear 0338

b. Turn the KILOCYCLES control clockwise until the stop is reached.

c. Turn the indicator dial drums to KILOCYCLES dial reading of +025. Tighten the clamp on the dial bevel gear.

d. Loosen the clamp on MEGACYCLES frequency indicator dial bevel gear 0337.

e. Turn the MEGACYCLES control counterclockwise until the stop is reached.

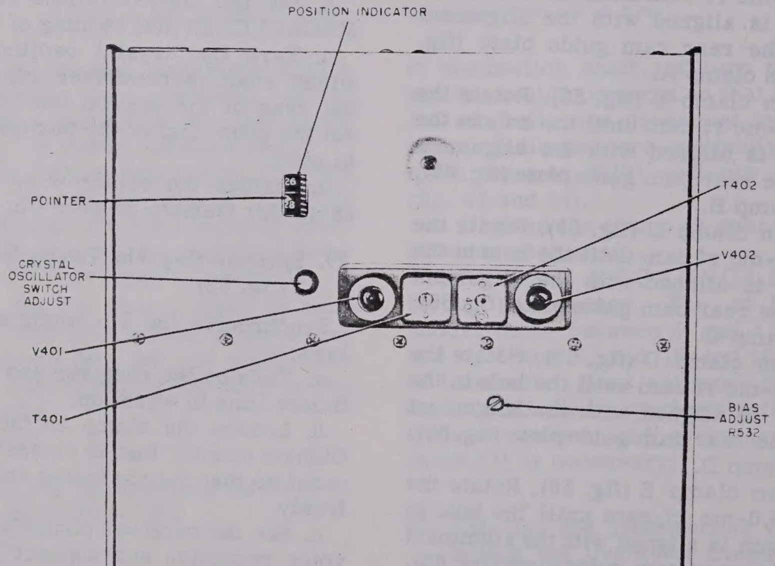


Figure 64. Receiver, rear view, case removed.

standard grease gun and a thin, long-handled brush should be used for applying grease to gear teeth, edges of cams, and tuning-rack guide slots. Rotate the MEGACYCLES and KILOCYCLES controls as necessary to expose all gear teeth.

Section III. SYNCHRONIZING MECHANICAL TUNING SYSTEM

71. Checking and Synchronizing Mechanical and Electrical System

The following procedures are used for checking and synchronizing the mechanical and electrical system. Paragraphs 72 through 75 outline the procedure for checking the mechanical and electrical synchronization and *must be carried out in the order given, otherwise the entire mechanical system will be misaligned.* Paragraphs 76 through 81 outline the procedure for synchronizing the mechanical and electrical system.

72. Checking Synchronization of Frequency Indicator Dial with MEGACYCLES and KILOCYCLES Control Shaft Stops

Check the synchronization of the indicator dial with the control stops as follows:

a. Turn the KILOCYCLES control slowly clockwise until the stop is reached. The KILOCYCLES dial reading should be between +015 and +035.

b. Turn the KILOCYCLES control slowly counterclockwise until the stop is reached. The KILOCYCLES dial should be between -985 and -965.

c. Turn the MEGACYCLES control clockwise until the stop is reached. The MEGACYCLES dial reading should be halfway between 31 and 32.

d. Turn the MEGACYCLES control counterclockwise until the stop is reached. The MEGACYCLES dial reading should be halfway between 00 and 99.

e. If the indications in *a* through *d* above are not obtained, proceed with paragraph 73.

73. Checking Rf Cam Synchronization

Determine whether the rf cams are synchronized by removing the receiver from its case (para 60), setting the frequency indicator to each of the readings listed in the first column of the following chart, and checking to see that the slug or can rack (fig. 59) listed opposite the frequency is at the top of its rise. If a slug or can rack is more than 1/32 inch from the top of its rise, synchronization is required (para 77).

Frequency indicator reading			Slug racks						1st variable if. slug rack	1st variable if. can rack	2d variable if. slug rack
Mc	±	Kc	1–2 mc	0.5–1 mc	2–4 mc	4–8 mc	8–16 mc	16–32 mc			
Any	–	075								Top	Top
Any	+	025	Top	Top							
03	+	025			Top						
07		Any							Top		
07	+	025				Top			Top		
15	+	025					Top				
31	+	025						Top			

74. Checking Crystal Oscillator Bandswitch S401 Against Frequency Indicator Dial

Check crystal oscillator bandswitch S401 by comparing the MEGACYCLES reading on the frequency indicator dial with the number under the pointer of the position indicator at the rear of the receiver (fig. 64). The numbers should be the same. If

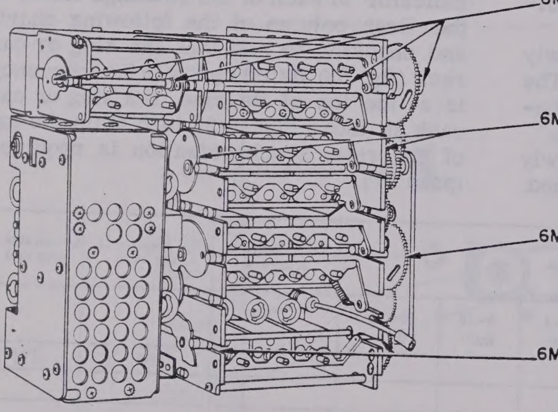
69. Cleaning

Loosen the 10-captive Allen-head screws around the edge of the front panel, and withdraw the receiver from its case (para 60). Remove the three Phillips screws from the gear cover plate (fig. 54) and remove the plate. Using a thin, long-handled, medium-bristled brush dipped in cleaning compound, remove all dirt, oil, and grease from the gears, cams, guide slots, and bearings. To gain access to all the gear teeth while cleaning, rotate the MEGACYCLES and KILOCYCLES knobs. After dipping the brush in cleaning compound, remove excess compound to prevent drops from falling onto connecting cables, wiring, or other electrical parts. Use a clean, lint-free cloth moistened with cleaning compound to remove grease from gear plates and chassis. Thoroughly wipe all parts with a clean, dry, lint-free cloth before proceeding with lubrication.

Warning: **Cleaning compound is flammable and its fumes are toxic. Do not use near a flame and provide adequate ventilation.**

70. Lubrication

Lubricate the mechanical tuning system as indicated in figure 63. The illustration shows the upper deck assembly removed from the receiver. To perform lubrication, remove the receiver from the case (para 60) and remove the gear cover plate (fig. 54). To apply oil to the bearings, dip a length of wire into the oil to collect a small drop at the end, and transfer the oil to the bearing by touching the end of the wire to the edge of the bearing. Avoid the use of excessive amounts of oil. A



INTERVAL –	LUBRICANT	
6M	MIL-L-644A	CAMSHAFT AND GEAR-SHAFT BEARINGS 1 OR 2 DROPS. OPERATE TO SPREAD.
6M	MIL-G-3278	SLUG RACK CAMS CLEAN AND APPLY THIN FILM ON EDGES.
6M	MIL-G-3278	TUNING MECHANISM GEARS CLEAN AND COAT TEETH SPARINGLY, REMOVE EXCESS LUBRICANT. OPERATE TO SPREAD.
6M	MIL-G-3278	GUIDE SLOTS CLEAN AND APPLY THIN FILM. OPERATE TO SPREAD.

UPPER DECK ASSEMBLY
TOP VIEW
(DO NOT REMOVE FOR LUBRICATION)

CLEANING—SOLVENT, DRY-CLEANING, ONLY WILL BE USED TO CLEAN PARTS. BEFORE LUBRICATING CLEAN SURFACES OF PARTS WITH LINTLESS CLOTH LIGHTLY DAMPENED WITH SOLVENT, DRY-CLEANING. DO NOT ALLOW CLEANING FLUID TO GET ON OTHER PARTS OF RECEIVER.

LUBRICANTS	INTERVAL
MIL-L-644A-LUBRICATING-OIL, PRESERVATIVE, SPECIAL. LOW TEMPERATURE.	6M-6 MONTHS
MIL-G-3278-GREASE, AIRCRAFT AND INSTRUMENTS. LOW AND HIGH TEMPERATURES	

TM5820-334-35-61

Figure 63. Radio Receiver R-392/URR, lubrication.

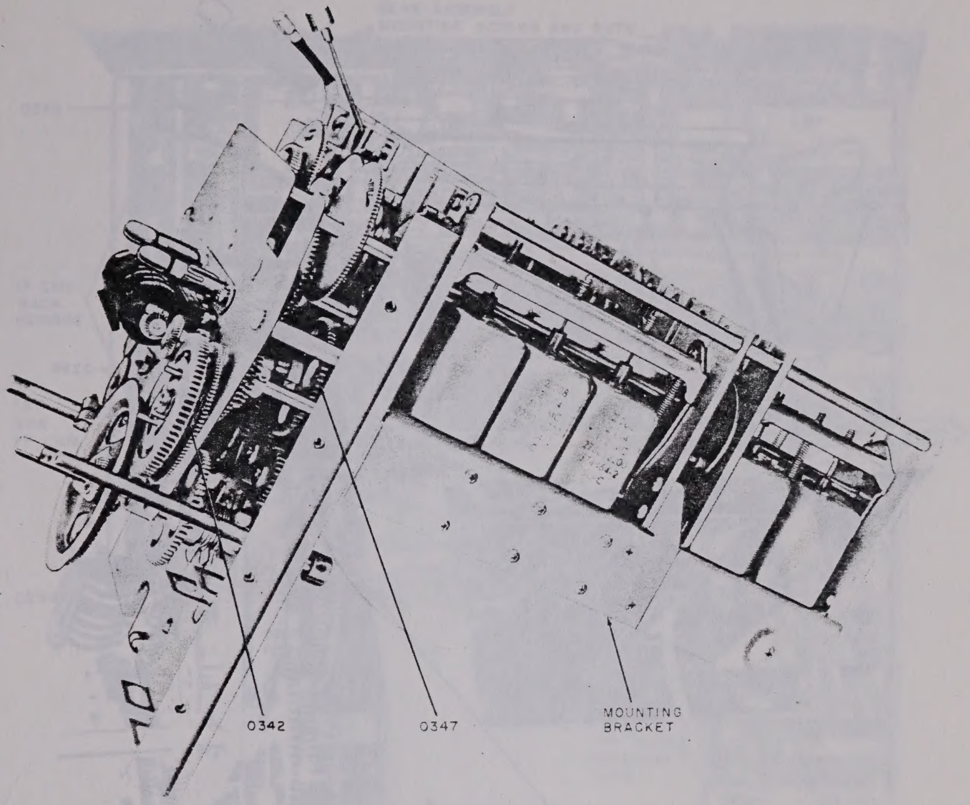


Figure 62. Gear train assembly and rf subchassis, right view.

Section II. LUBRICATION

8. Lubrication Intervals and Precautions

The only part of the receiver which requires lubrication is the mechanical tuning system. The system is lubricated initially at the factory and should be lubricated hereafter once every 6 months, under normal operating conditions. The lubrication nterval should be shortened only if the need is indicated by inspection or if abnormal conditions or activities are encountered. It must be remembered that overlubrication can often cause more harm than no lubrication. Check the condition of the mechanical tuning system whenever the receiver is withdrawn from the case for servicing. Work the KILOCYCLES and MEGACYCLES controls, and check for ease of operation. Check for lack of lubricant on gears, edges of cams, guide slots, and bearings; inspect for gritty grease and oil.

Caution: **Never attempt to lubricate the sealed vfo, regardless of possible noisy operation during its tuning, or unstable operation of the oscillator may result.**

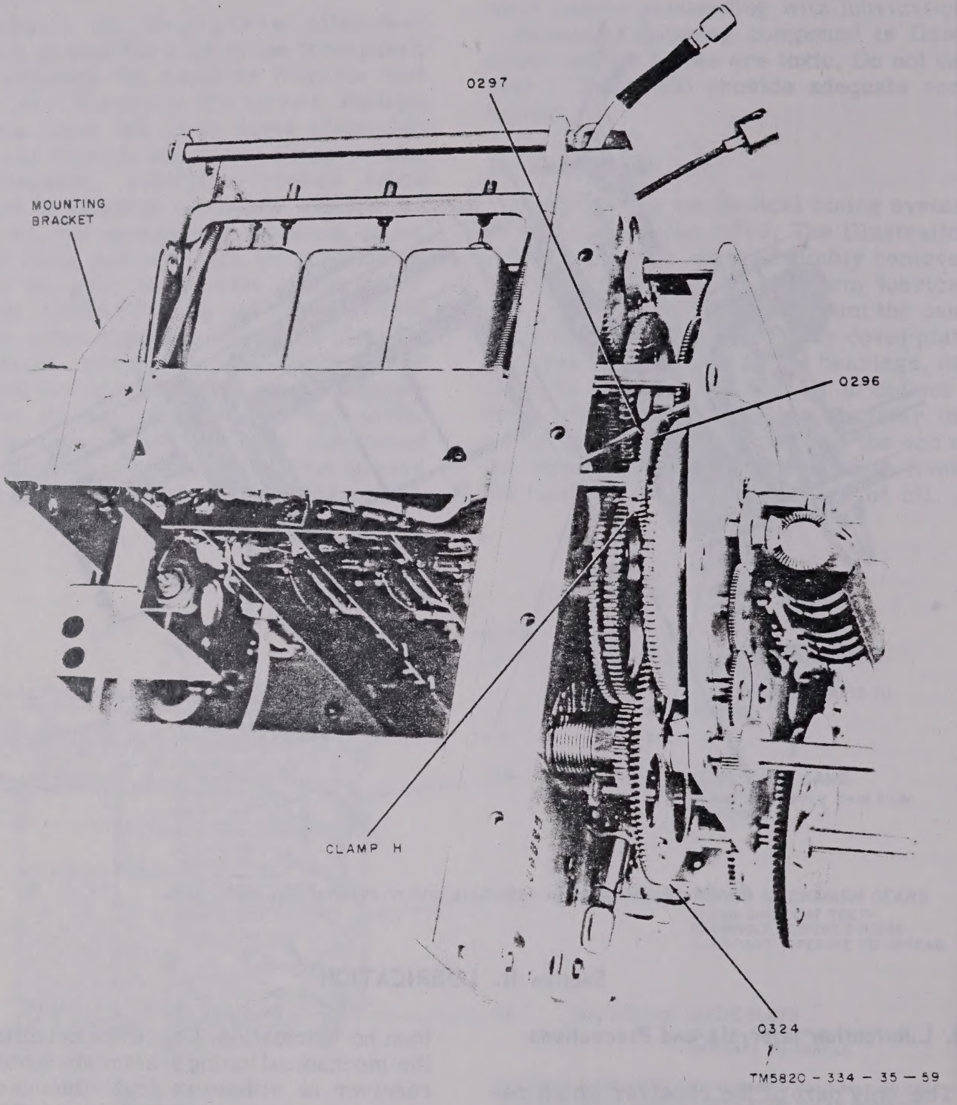


Figure 61. Gear train assembly and rf subchassis, left view.

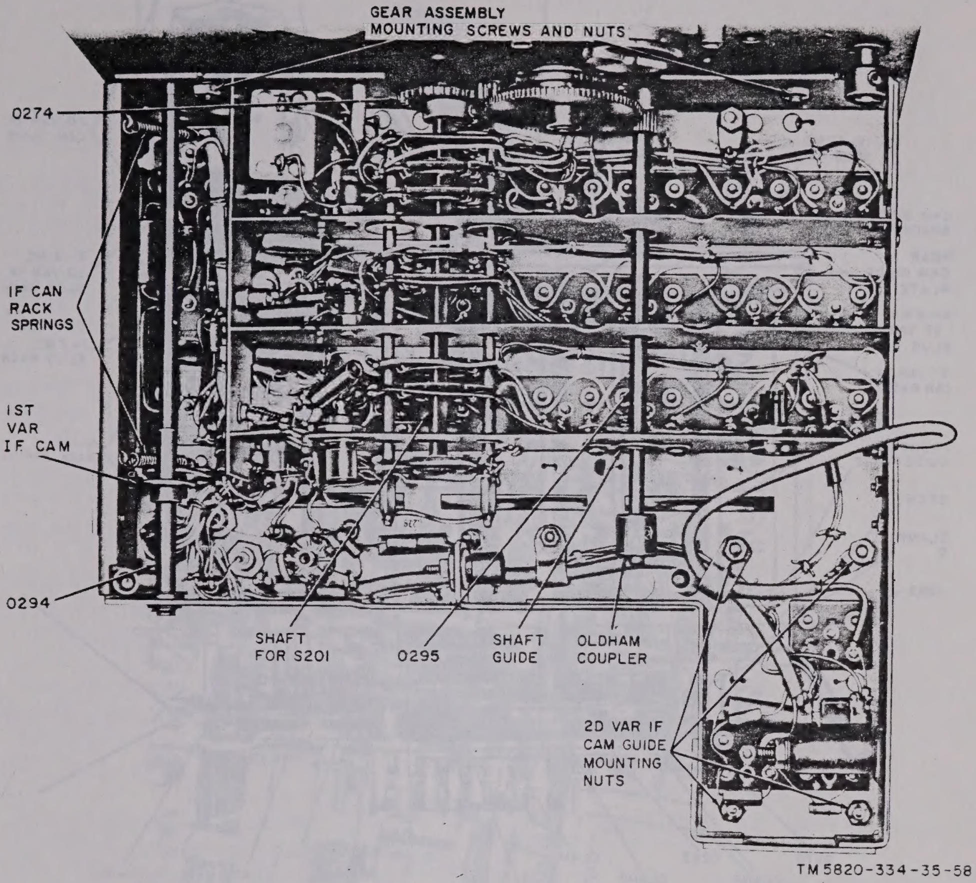


Figure 60. Rf subchassis, bottom view.

(14) Replace all slug rack springs (fig. 59).

(15) Replace the first variable if. can rack springs (fig. 60).

(16) Replace all tubes and tube shields in the rf subchassis (fig. 43).

(17) Replace the cam guide bracket on the rear cam guide plate (fig. 59).

(18) Replace the crystal oscillator subchassis (para 65).

- *(a)* If shaft 0295 is out of line with the crystal oscillator shaft, loosen the two screws in the shaft guide for shaft 0295 (fig. 60), align the shafts, and tighten the screws in the shaft guide.
- *(b)* Loosen the setscrew in the Oldham coupler at the end of shaft 0295 and fit the coupler insert to the two sections of the coupler (fig. 57). Tighten the setscrew in the coupler.

(19) Check the synchronization of six-position rf bandswitch S201 and adjust if necessary (para 80).

(20) Check the synchronization of crystal oscillator bandswitch S401 and adjust if necessary (para 74).

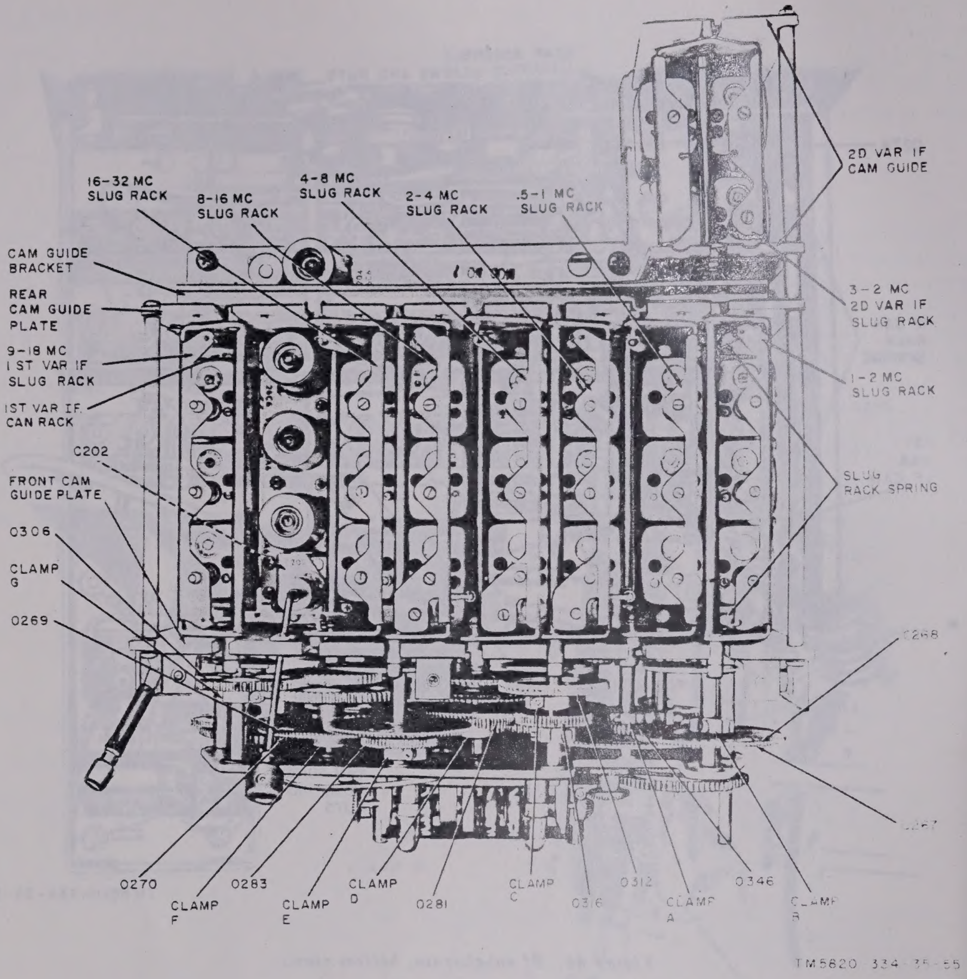


Figure 59. Gear train assembly and rf subchassis, top view.

cam guide. Mount the flexible coupling guide bracket with two screws.

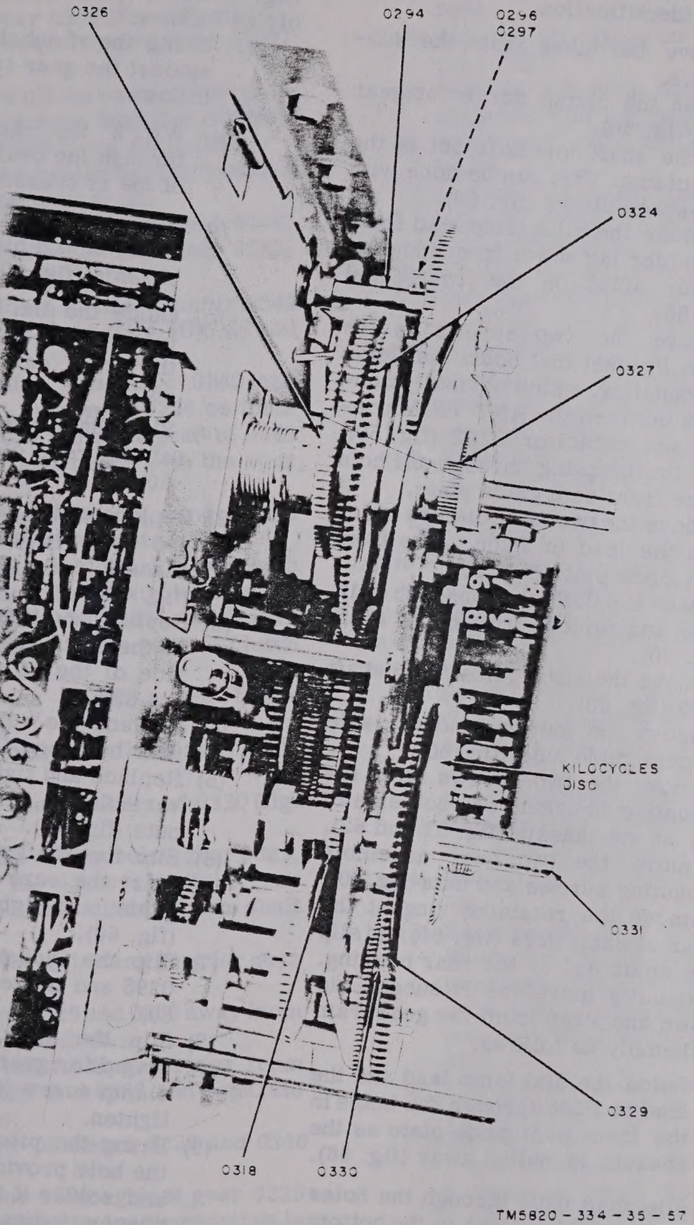
(11) Replace the two cable clamps that hold the lead to P206 to the front cam guide plate (fig. 56).

(12) Replace all rf tuning coils and transformers as follows:

(a) Place each coil or transformer in its proper socket (fig. 43).

(b) Insert the mounting screws in th two holes of the can and carefully tighten them with a smal Phillips screwdriver.

(13) Replace all slug racks. Work carefully to avoid breakage or damag to the slugs. Be sure each slu rack is placed in the proper cam guide slots.



	Shaft, 1st variable if. cam	0326	Gear, spur, 32-tooth
nd 0297	Gear assembly, antibacklash, 72-tooth	0327	Gear, spur, 36-tooth
	Gear, spur, 17-tooth	0329 and 0330	Gear assembly, antibacklash, 90-tooth
	Gear, antibacklash, 100-tooth	0331	Shaft, kilocycles

Figure 58. Gear assembly, bottom view.

- *(c)* Mark the coils and transformers for identification.

(8) Remove the tubes from the subchassis.

(9) Loosen the clamp screw for gear 0274 (fig. 60).

(10) Slip the shaft for S201 out of the gear clamp. This can be done with long-nosed pliers (fig. 60).

(11) Unsolder the pilot lamp lead from the solder lug above frequency indicator M201 on the front panel (fig. 56).

(12) Remove the two screws in the guide bracket that holds the flexible coupling, which normally connects between the ANT TRIM control and capacitor C202 (fig. 59). Slip the coupling through the hole in the front cam guide plate.

(13) Remove the two cable clamps which hold the lead to P206 to the front cam guide plate (fig. 56).

(14) Loosen the Oldham coupler on shaft 0295 and remove it from the shaft (fig. 60).

(15) Remove the shaft guide from shaft 0295 (fig. 60).

(16) Remove the four second variable if. cam guide nuts (fig. 60).

(17) Remove the two screws from the mounting brackets on each side of the rf subchassis (fig. 61 and 62).

(18) Remove the two gear assembly mounting screws and nuts (fig. 60).

(19) Remove the retaining ring at the rear of shaft 0294 (fig. 60) and slip the shaft out of the rear bearing.

(20) Carefully move the rf subchassis down and away from the gear train assembly as follows:

- *(a)* Guide the dial lamp lead and the lead to P206 through the holes in the front cam guide plate as the chassis is pulled away (fig. 56).
- *(b)* Slip shaft 0295 through the holes in the shield plates in the bottom of the rf chassis (fig. 60).
- *(c)* Work the cam on shaft 0294 through the oval hole in the front of the rf subchassis (fig. 60).

n. Replacement of Gear Train Assemb (fig. 59-62). Replace the gear train assen bly as follows:

(1) Bring the rf subchassis into pla against the gear train assembly follows:

- *(a)* Work the cam on shaft 02 through the oval hole in the fro of the rf chassis (fig. 60).
- *(b)* Slip shaft 0295 through the hol in the shield plates in the rf su chassis (fig. 60).
- *(c)* Guide the dial lamp lead and t lead to P206 through the holes the front cam guide plate (fi 56).
- *(d)* Slip shaft 0294 into the beari at the rear of the chassis (fi 60).

(2) Replace and tighten the two scre and nuts which secure the rf su chassis to the gear train assemb (fig. 60).

(3) Replace and tighten the two scre in the mounting brackets on ea side of the rf subchassis (fig. and 62).

(4) Replace the retaining ring at t rear bearing of shaft 0294 (fig. 6

(5) Replace and tighten the four seco variable if. cam guide mounti nuts (fig. 60).

(6) Slip the shaft guide on shaft 029 Start the screws, center the sha guide, and tighten the two scre (fig. 60).

(7) Slip the Oldham coupler on sha 0295 and tighten the setscrews (fi 60).

(8) Slip the shaft for S201 into t clamp for gear 0274 and tighten t clamp screw (fig. 60). Do not ove tighten.

(9) Bring the pilot lamp lead throu the hole provided in the front pla and solder it to the lug above fre quency indicator M201 (fig. 56

(10) Slip the coupling, which normal connects between the ANT TR control and capacitor C202 (fi 59), through the hole in the fro

i. Removal of Clutch Assembly 0342 and evel and Spur Gear 0336 (fig. 56 and 58).

(1) Remove frequency indicator M201 (*a* above).

(2) Loosen the clamp screw below gear 0329 and remove the kilocycle disk and gear 0329 from shaft 0331.

(3) Remove the retaining ring from the clutch assembly shaft.

(4) Remove bevel and spur gear 0336, along with clutch assembly 0342, from its shaft.

j. Replacement of Clutch Assembly 0342 nd Bevel and Spur Gear 0336 (fig. 56 and 3).

(1) Place clutch assembly 0342 and bevel and spur gear 0336 on their shafts. Load the split gear of 0342 two teeth and mesh with the spur gear of 0336.

(2) Replace the retaining ring on the clutch assembly shaft.

(3) Load gear 0329 (fig. 57) two teeth and replace the kilocycle disk and gear 0329 on shaft 0331; mesh gear 0329 with the brass gear of clutch assembly 0342.

(4) Tighten the clamp screw below gear 0329.

(5) Replace frequency indicator M201 (*b* above).

k. Removal of Gears 0329 and 0330 (fig. 3).

(1) Loosen the clamp below gear 0329.

(2) Remove the kilocycle disk, gear 0329, and the clamp from shaft 0331.

(3) Remove the retaining ring for gear 0330.

(4) Slip gears 0329 and 0330 away from the kilocycle disk.

(5) Unhook the loading springs from gears 0329 and 0330 and separate the gears.

l. Replacement of Gears 0329 and 0330 ig. 56 and 58).

(1) Place gear 0330 against gear 0329 and hook the two loading springs in the holes provided in the gears.

(2) Place the assembly of gears 0329 and 0330 against the kilocycle disk with the pin of gear 0330 through the fork on the kilocycle disk (fig. 56).

(3) Replace the retaining ring for gear 0329.

(4) Replace the clamp on the sleeve of gear 0330.

(5) Slip the kilocycle disk and gears 0329 and 0330 on shaft 0331.

(6) Load gears 0329 and 0330 two gear teeth.

(7) Turn the assembly until the slot in the 0330 sleeve is aligned with the pin in shaft 0331.

(8) Engage the gears of the assembly with the brass gear of the clutch assembly. Do not lose the loading.

(9) Move the gear assembly along the shaft so the split gears are centered on the brass gear of clutch assembly 0342.

(10) Tighten the screw in the clamp on gear 0330. Do not overtighten.

m. Removal of Gear Train Assembly from Rf Subchassis (fig. 59-62). Remove the upper deck assembly (para 63) before removing the gear train assembly from the rf subchassis. Remove the gear train assembly as follows:

(1) Set the MEGACYCLES and KILOCYCLES controls for a reading of 02300 on the frequency indicator.

(2) Remove the crystal oscillator from the rf subchassis (para 65).

(3) Remove the cam guide bracket on the rear cam guide plate (fig. 59).

(4) Unhook all slug rack springs (fig. 59).

(5) Remove all slug racks (fig. 59). Work carefully to avoid damage or breakage. Identify each slug rack with a pencil mark so that they can be replaced in the proper cam guide slot.

(6) Unhook the first variable if. cam rack springs (fig. 60).

(7) Remove all rf tuning coils and transformers as follows:

  (a) Insert a small Phillips screwdriver carefully into the two holes in a coil or transformer can, and loosen the screws until they are free of the subchassis.

  (b) Withdraw the coil or transformer from the subchassis.

in the coil or transformer can, and loosen the screws until they are free of the subchassis.

(4) Withdraw the coil or transformer from the subchassis.

b. Replacement. Replace the rf tuning coils and transformers as follows:

(1) Plug the coil or transformer into its socket.

(2) Replace the two small Phillips screws into the holes in the coil or transformer can and tighten them.

(3) Replace the slug rack associated with the coil or transformer and hook the spring located at each end of the slug rack.

(4) Replace the cam guide bracket on the rear cam guide plate, and replace and tighten the eight screws.

67. Removing and Replacing Parts in Mechanical Tuning System

Note. Removal and replacement of the rf gear train assembly (*m* and *n* below) is performed at fourth echelon.

a. Removal of Frequency Indicator M201 (fig. 56).

(1) Remove the receiver from the case (para 60).

(2) Remove the front panel from the receiver (para 61).

(3) Note the frequency indicated on M201. *Do not turn the MEGACYCLES or KILOCYCLES controls during this procedure.*

(4) Remove the four Phillips screws which hold frequency indicator M201.

(5) Remove frequency indicator M201.

b. Replacement of Frequency Indicator M201 (fig. 56).

(1) Set frequency indicator M201 to read the same frequency as before removal (*a*(3) above).

(2) Align frequency indicator M201 with the mounting holes on the front plate.

(3) Replace the four screws which hold frequency indicator M201.

(4) Replace the front panel (para 61).

(5) Replace the receiver in the case (para 60).

c. Removal of Spur Gear 0339 or 034 (fig. 56).

(1) Remove the receiver from the case (para 60).

(2) Remove the front panel from the receiver (para 61).

(3) Remove the retaining ring from the gear shaft and remove the spur gear.

d. Replacement of Spur Gear 0339 or 0340 (fig. 56).

(1) Replace the gear and secure with retaining ring.

(2) Replace the front panel (para 61).

(3) Replace the receiver in the case (para 60).

e. Removal of Gear Assembly 0341 (fig 56).

(1) Remove frequency indicator M201 (*a* above).

(2) Remove gear assembly 0341 from its shaft.

f. Replacement of Gear Assembly 034 (fig. 56).

(1) Slip gear assembly 0341 on its shaft.

(2) Replace frequency indicator M201 (*b* above).

g. Removal of Bevel Gear 0337 or 0338 (fig. 56).

(1) Remove frequency indicator M201 (*a* above).

(2) Loosen the clamp screw for the bevel gear and remove the bevel gear.

h. Replacement of Bevel Gear 0337 or 0338 (fig. 56).

(1) Slip the bevel gear on the shaft.

(2) Replace frequency indicator M201 (*b*(1), (2), and (3) above).

(3) Set frequency indicator M201 to indicate the same frequency as before removal (*a*(3) above).

(4) Position the bevel gear firmly against the gear assembly and tighten the clamp screw on the bevel gear.

(5) Replace the front panel (para 61).

(6) Replace the receiver in the case (para 60).

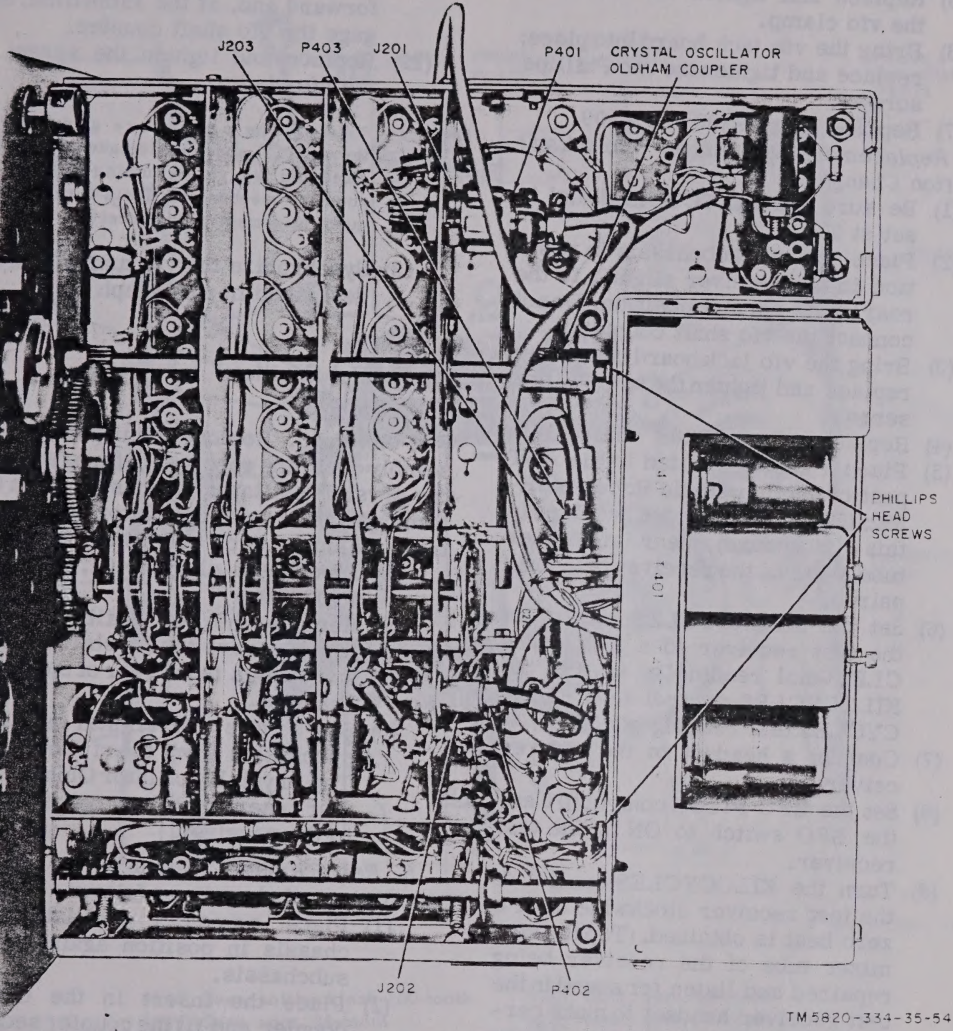


Figure 57. Upper deck assembly and crystal oscillator subchassis, bottom view.

Rf Tuning Coils and Transformers
(fig. 59)

Removal. Remove the rf tuning coils transformers by first removing the r deck assembly (para 63). Proceed llows:

1) Remove the eight screws on the cam guide bracket on the rear cam guide plate and remove the bracket.

(2) To remove the slug rack associated with a coil or transformer, unhook the spring located at each end of the slug rack and remove the slug rack. Be careful that the springs do not fall into the subchassis.

(3) Insert a small Phillips screwdriver carefully into the two holes

(5) Replace and tighten the screw in the vfo clamp.
(6) Bring the vfo jack board into place; replace and tighten the two Phillips screws.
(7) Replace plugs P208 and P109.

c. Replacement Procedure, Vfo Shaft Position Changed.

(1) Be sure the KILOCYCLES dial is set at 500.
(2) Place the vfo subchassis in position in the receiver slightly to the rear of its normal position. Do not connect the vfo shaft coupler.
(3) Bring the vfo jack board into place; replace and tighten the two Phillips screws.
(4) Replace plugs P208 and P109.
(5) Place a lead connected to the ANT post of another Radio Receiver R-392/URR (called a test receiver in this procedure) near vfo-mixer tube V801 of the receiver being repaired.
(6) Set the MEGACYCLES control of the test receiver to a MEGACYCLES dial reading of 02 and the KILOCYCLES control to a KILOCYCLES dial reading of 455.
(7) Connect a headset to the test receiver.
(8) Set the BFO PITCH control to 0 and the BFO switch to ON on the test receiver.
(9) Turn the KILOCYCLES control of the test receiver clockwise until a zero beat is obtained. (Tap the vfo-mixer tube of the receiver being repaired and listen for sound in the test receiver headset to make certain the beat is with the signal from the vfo.)
(10) Turn the KILOCYCLES control of the test receiver toward a KILOCYCLES dial reading of 955; at the same time, turn the vfo shaft of the receiver being repaired, maintaining a beat note in the headset, until a dial reading of 955 on the test receiver is reached. Turn the vfo shaft for a zero beat at this dial reading.
(11) Replace the insert in the vfo shaft coupler, slide the vfo subcha
forward and, at the same time,
gage the vfo shaft coupler.
(12) Replace and tighten the scre
the vfo clamp.

Note. The procedure given in
through (12) above is designed to pr
damaging the vfo by turning its sha
yond the mechanical limits during s
quent alignment of the receiver.

(13) Synchronize the vfo tuning sha
described in paragraph 79.

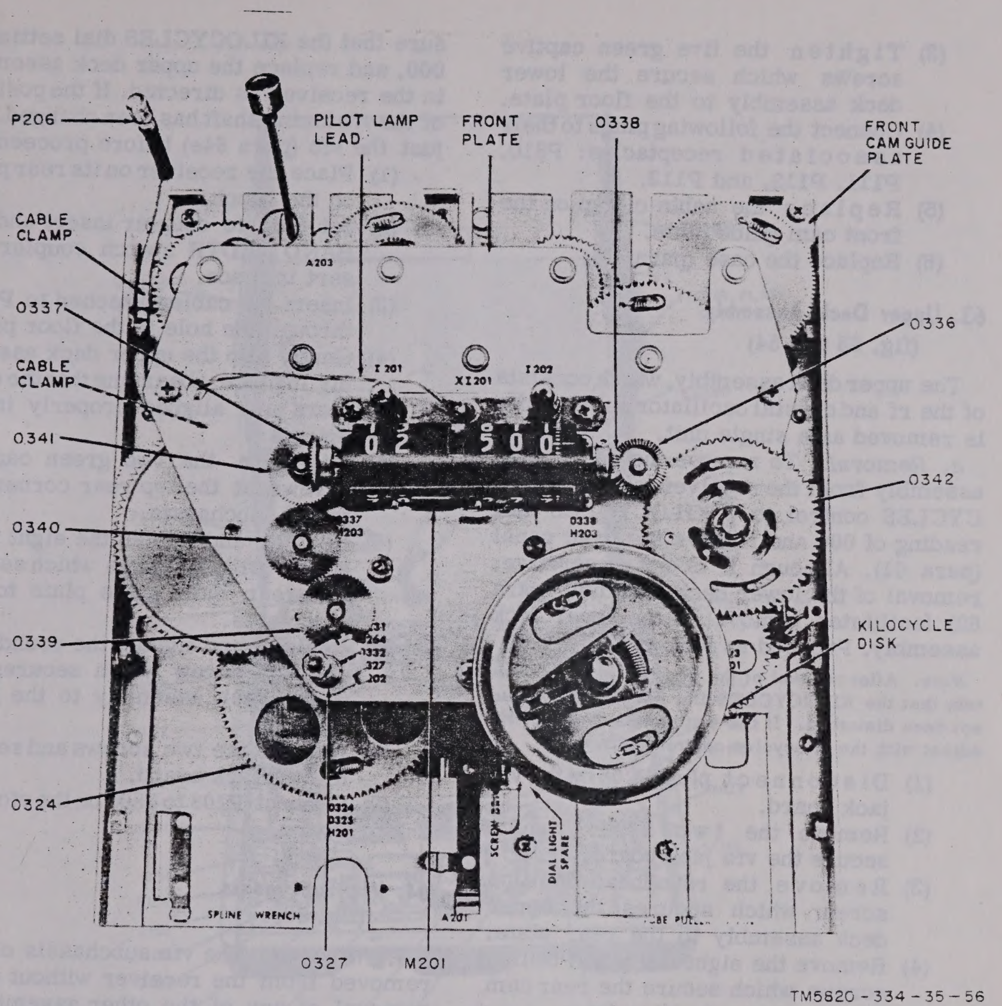
65. Crystal Oscillator Subchassis
(fig. 57)

a. Removal. Remove the upper deck
sembly from the receiver before remo
the crystal oscillator subchassis (para
Remove the crystal oscillator subcha
from the upper deck assembly as foll

(1) Disconnect plugs P401, P402,
P403.
(2) Remove the two Phillips scr
which secure the crystal oscill
subchassis to the rear of the rf s
chassis.
(3) Separate the crystal oscill
subchassis from the rf subcha
The crystal oscillator Oldham c
pler insert will drop out; secu
to the receiver.

b. Replacement. Replace the cry
oscillator subchassis as follows:

(1) Place crystal oscillator s
chassis in position against th
subchassis.
(2) Place the insert in the Old
coupler and fit the coupler secti
together.
(3) Replace the two screws which
cure the crystal oscillator s
chassis to rear of the rf subch
sis.
(4) Connect the following plugs
receptacles: P401 to J201, P40
J202, and P403 to J203.
(5) Check the synchronization of
crystal oscillator subchassis
adjust if necessary (para 74
78).



0324	Gear, antibacklash 100-tooth	0339	Gear, spur, 64-tooth
0327	Gear, spur, 36-tooth	0340	Gear, spur, 64-tooth
0336	Gear, bevel and spur	0341	Gear assembly, bevel and spur
0337	Gear, bevel, 48-tooth	0342	Clutch assembly
0338	Gear, bevel, 24-tooth		

Figure 56. Upper deck assembly, front view.

b. Replacement Procedure, Vfo Shaft osition not Changed.

(1) Be sure that the KILOCYCLES dial is at the reference setting of 500 and the vfo shaft has not been turned.

(2) Place the vfo subchassis in position in the receiver slightly to the rear of its normal position.

(3) Replace the insert in the vfo shaft coupler.

(4) Slide the vfo subchassis toward the front of the receiver, at the same time engaging the vfo shaft coupler.

(3) Tighten the five green captive screws which secure the lower deck assembly to the floor plate.
(4) Connect the following plugs to their associated receptacles: P810, P111, P112, and P113.
(5) Replace the cable clamp on the front cam guide plate.
(6) Replace the case (para 60).

63. Upper Deck Assembly
(fig. 53 and 54)

The upper deck assembly, which consists of the rf and crystal oscillator subchassis, is removed as a single unit.

a. Removal. To remove the upper deck assembly from the receiver, set the KILOCYCLES control to a KILOCYCLES dial reading of 000 and remove the front panel (para 61). Although it is not imperative, removal of the lower deck assembly (para 62) facilitates removal of the upper deck assembly. Proceed as follows:

Note. After removal of the front panel, make certain that the KILOCYCLES dial reading of 000 has not been disturbed. If the setting has changed, readjust with the kilocycles control shaft.

(1) Disconnect plug P208 on the vfo jack board.
(2) Remove the two screws which secure the vfo jack board.
(3) Remove the roundhead Phillips screw which secures the upper deck assembly to the rear plate.
(4) Remove the eight flathead Phillips screws which secure the rear cam guide plate to the sideplates.
(5) Loosen the two green captive screws at the top rear corners of the rf subchassis.
(6) Remove the upper deck assembly by pulling the assembly forward, then upward. The BAND WIDTH switch coupler insert will drop out; secure the insert to the sideplate. Be careful not to damage the coaxial cable attached to plug P208. The vfo coupler insert will drop down; secure it to the sideplate of the receiver.

b. Replacement. If the position of the vfo tuning shaft has not been changed, make sure that the KILOCYCLES dial setting
000, and replace the upper deck assemb
in the receiver as directed. If the positi
of the vfo tuning shaft has been changed, a
just the vfo (para 64*e*) before proceedin

(1) Place the receiver on its rear pla
on the bench.
(2) Set the vfo coupler insert and t
BAND WIDTH switch coupler i
sert in place.
(3) Insert the cable (attached to P20
through the hole in the floor plat
(4) Gently slip the upper deck assen
bly in place, observing that the co
plers are aligned properly in t
inserts.
(5) Tighten the two green capti
screws at the top rear corners
the rf subchassis.
(6) Replace and tighten the eight fla
head Phillips screws which secu
the rear cam guide plate to t
sideplates.
(7) Replace and tighten the roundhe
Phillips screw which secures t
upper deck assembly to the re
plate.
(8) Replace the two screws and secu
the vfo jack board.
(9) Connect P208 to J808 on the vfo ja
board.

64. Vfo Subchassis
(fig. 53)

a. Removal. The vfo subchassis can
removed from the receiver without pri
removal of any of the other assemblie
Proceed as follows:

(1) Set the KILOCYCLES dial at 5
(last three digits on frequency i
dicator dial).
(2) Disconnect plugs P208 and P10
(3) Remove the two Phillips screw
from the vfo jack board.
(4) Remove the screw from the v
clamp.
(5) Slide the vfo subchassis towa
the rear of the receiver to dise
gage the vfo shaft coupler and l
out the subchassis. The vfo sha
coupler insert will drop out; secu
it to the receiver.

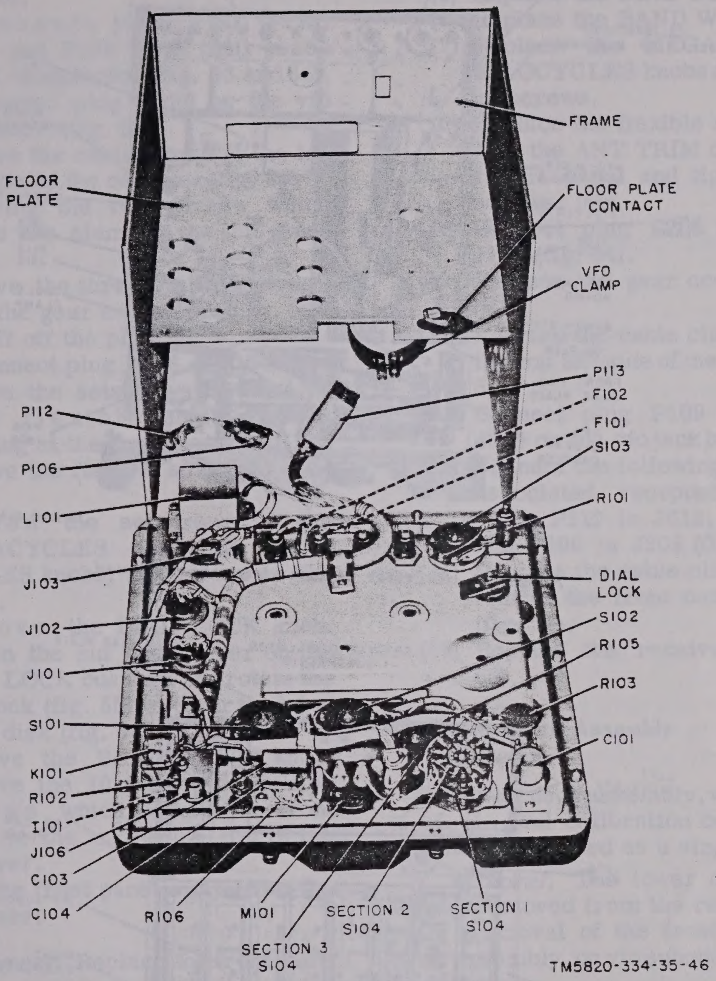


Figure 55. Front panel assembly, rear view.

(5) Slide the lower deck assembly back and lift straight up from the frame. The BAND WIDTH switch coupler (Oldham type) insert will drop out; secure it to the sideplate of the receiver.

Replacement. Replace the lower deck embly as follows:

(1) Replace the insert in the BAND WIDTH switch coupler (Oldham type).

(2) Lower the lower deck assembly into position. Make sure the cable attached to plug P810 is held clear when lowering the assembly into place so that the cable will not become wedged between the assembly and receiver frame.

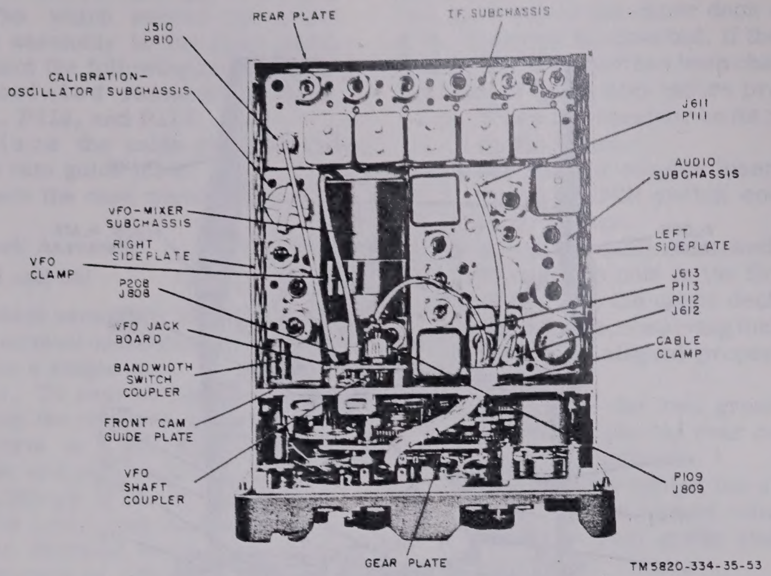


Figure 53. Receiver, bottom view, case removed.

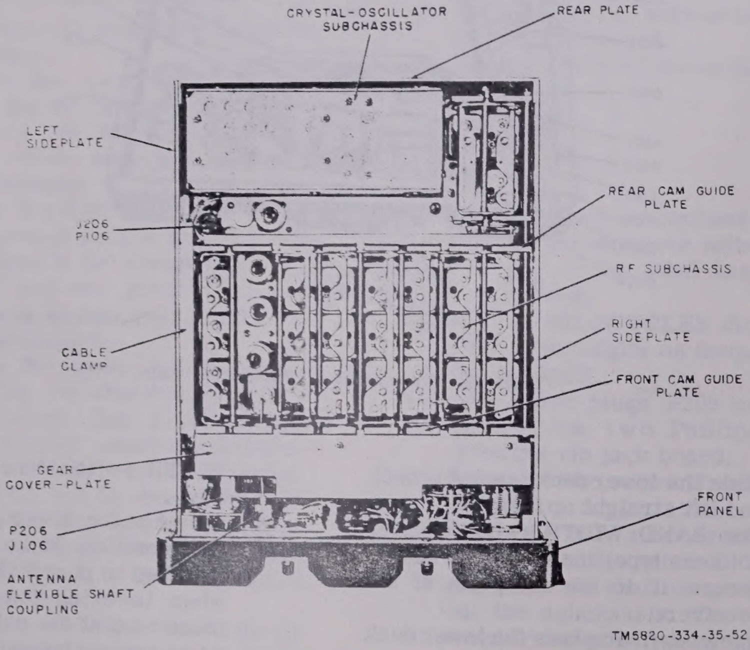


Figure 54. Receiver, top view, case removed.

(2) Remove the cable clamp from the bottom of the front cam guide plate (fig. 53).
(3) Disconnect plugs P111, P112, P113, and P106 from their associated receptacles (fig. 53 and 54).
(4) Disconnect plug P109 on the vfo jack board (fig. 53).
(5) Remove the cable clamp at the top left side of the receiver (fig. 54) by removing the two screws which secure the clamp to the left sideplate.
(6) Remove the three Phillips screws from the gear coverplate (fig. 54), and lift off the plate.
(7) Disconnect plug P206 (fig. 54).
(8) Loosen the setscrews on the ANT TRIM flexible shaft (fig. 54) coupling at the front panel end, and remove the flexible shaft and coupling.
(9) Loosen the setscrews in the MEGACYCLES and the KILOCYCLES knobs, and remove the knobs.
(10) Remove the DIAL LOCK knob. Loosen the nut and washer on the DIAL LOCK bushing, and rotate the dial lock (fig. 55) to clear the kilocycle disk (fig. 56).
(11) Remove the BAND WIDTH knob.
(12) Remove the 10 flat-head Phillips screws which secure the front panel to the sideplates of the receiver.
(13) Pull the front panel away from the receiver.

b. Replacement. Replace the front panel as follows:

(1) Bring the front panel into place against the receiver.
(2) Replace and tighten the 10 flat-head Phillips screws which secure the front panel to the sideplates of the receiver.
(3) Rotate the dial lock mechanism so that the jaws of the dial lock are in position to grasp the kilocycle disk (fig. 55 and 56).
(4) Tighten the nut on the DIAL LOCK bushing. Be sure the dial lock mechanism is in the proper position.
(5) Replace the DIAL LOCK knob.
(6) Replace the BAND WIDTH knob.
(7) Replace the MEGACYCLES and KILOCYCLES knobs and tighten the setscrews.
(8) Replace the flexible shaft coupling onto the ANT TRIM coupling at the front panel and tighten the setscrews.
(9) Connect plug P206 to receptacle J106 (fig. 54).
(10) Replace the gear cover plate (fig. 54).
(11) Replace the cable clamp located at the top left side of the receiver (fig. 54).
(12) Connect plug P109 to receptacle J809 on the vfo jack board (fig. 53).
(13) Connect the following plugs in their associated receptacles: P111 in J611, P112 in J612, P113 in J613 and P106 in J206 (fig. 53 and 54).
(14) Replace the cable clamp at the bottom of the front cam guide plate (fig. 53).
(15) Replace the receiver case (para 60).

62. Lower Deck Assembly

(fig. 53)

The lower deck assembly, which consists of af, if., and calibration oscillator subchassis is removed as a single unit.

a. Removal. The lower deck assembly can be removed from the receiver without prior removal of the front panel, upper deck assembly, or vfo subchassis. Proceed as follows:

(1) Remove the receiver case (para 60) and place the receiver on the workbench with the lower deck assembly up.
(2) Remove the cable clamp from the front cam guide plate.
(3) Disconnect plugs P810, P111, P112, and P113 from their associated receptacles.
(4) Loosen the five green captive screws which secure the lower deck assembly to the floor plate.

CHAPTER 3

REPAIRS AND ALIGNMENT

Note. All repairs and alignment may be performed by third echelon maintenance personnel unless othe wise noted.

Section I. REPAIRS

58. General Parts Replacement Techniques

Most of the parts in the receiver can be reached and replaced without special procedures. The following precautions apply specifically to this receiver.

a. When a ceramic-type capacitor is soldered, be careful not to overheat the capacitor. Use a pencil-type soldering iron with a 25-watt maximum capacity.

b. When soldering in the transistorized audio module, use a pencil-type soldering iron with a 25-watt maximum capacity. Before using a soldering iron, check for a short between the element and the tip. *Do not use if shorted.* Use an isolating transformer when only an ac operated iron is available. When soldering a transistor, grasp the lead between the transistor and the solder connection with a pair of long-nosed pliers to dissipate the heat.

59. Removal and Replacement

Note. Removal and replacement of the rf gear train assembly is performed at fourth echelon.

All subchassis, except the rf subchassis, can be removed from the receiver without prior removal of any of the other assemblies. When the rf and vfo subchassis are removed from the receiver, avoid changing the positions of the kilocycles and vfo tuning shafts, since this will necessitate synchronization checks. Where possible, preset the receiver controls before removing the subchassis. Subchassis mounting (captive) screws are color-coded with green heads. When removing a subchassis, loosen the captive screws enough to free them from the main frame. When replacing a subchassis, properly position the subchassis and start all captive screws before tightening them all the way. To remove a coaxial plug, press the plug i slightly and twist counterclockwise to release, then pull the plug straight out. Wher coaxial plugs are not readily accessible use Tube Puller TL-201 to remove th plugs. Do not loosen gear clamp screws to much; the clamp screw nuts may drop off Excessive tightening of the clamp screw may strip the threads. Fully insert a Brist wrench to avoid stripping the slots in th screwhead.

60. Receiver Case

a. Removal. Remove the receiver cas as follows:

(1) Loosen the 10 captive Allen-hea screws around the edges of th front panel by turning the screw counterclockwise until they ar completely free of the case.
(2) Carefully tilt the receiver until i rests on its front panel.
(3) Lift off the case.

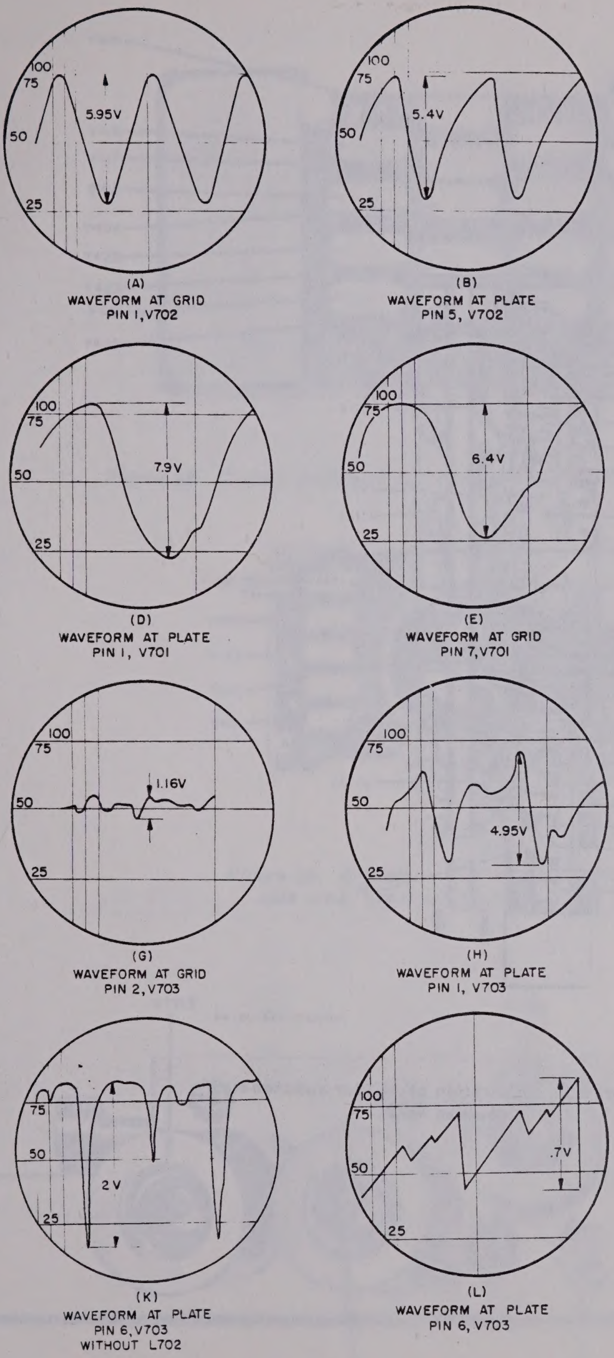
b. Replacement. Replace the receive case as follows:

(1) Place the receiver on its fron panel.
(2) Slip the case over the receiver.
(3) Carefully place the receiver in th normal position.
(4) Tighten the 10 captive Allen-hea screws in the front panel.

61. Front Panel

a. Removal. To gain access to the parts mounted on the front panel or to prepare for removal of the upper deck assembly (para 63), remove the front panel as follows:

(1) Remove the receiver case (para 60).



(A)
WAVEFORM AT GRID
PIN 1, V702

(B)
WAVEFORM AT PLATE
PIN 5, V702

(C)
WAVEFORM AT GRID
PIN 2, V701

(D)
WAVEFORM AT PLATE
PIN 1, V701

(E)
WAVEFORM AT GRID
PIN 7, V701

(F)
WAVEFORM AT PLATE
PIN 6, V701

(G)
WAVEFORM AT GRID
PIN 2, V703

(H)
WAVEFORM AT PLATE
PIN 1, V703

(J)
WAVEFORM AT GRID
PIN 7, V703

(K)
WAVEFORM AT PLATE
PIN 6, V703
WITHOUT L702

(L)
WAVEFORM AT PLATE
PIN 6, V703

TM5820-334-35-83

Figure 52. Waveforms in calibration oscillator subchassis.

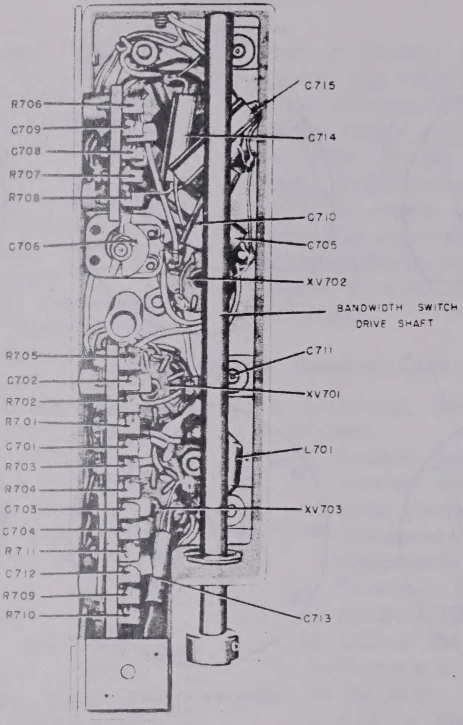


Figure 51. Calibration oscillator subchassis, bottom view.

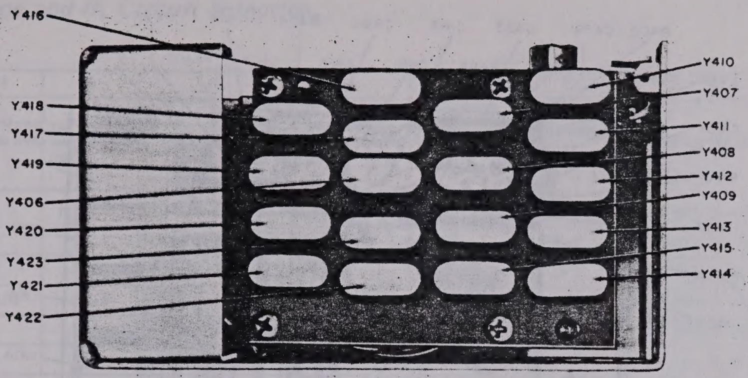


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Figure 48. Crystal oscillator subchassis, left side view, cover removed.

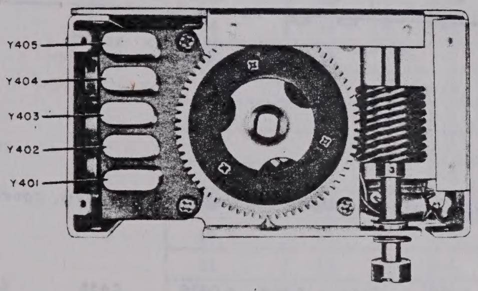

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Figure 49. Crystal oscillator subchassis, right side view, cover removed.

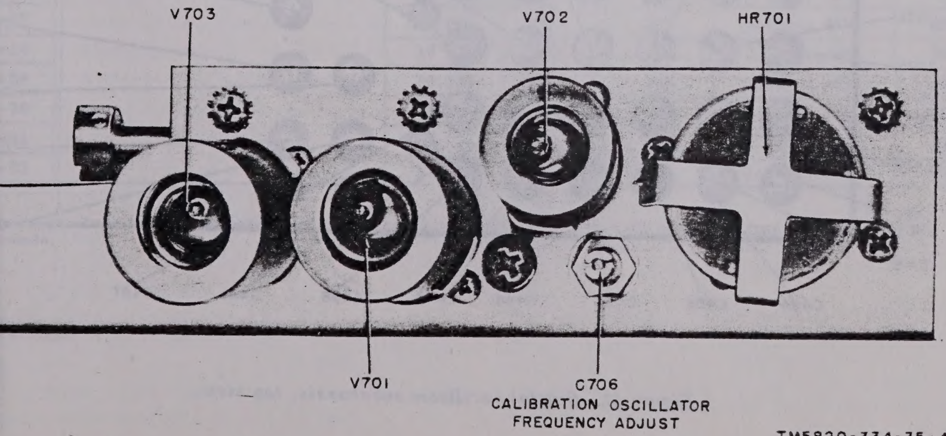

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Figure 50. Calibration oscillator subchassis, top view.

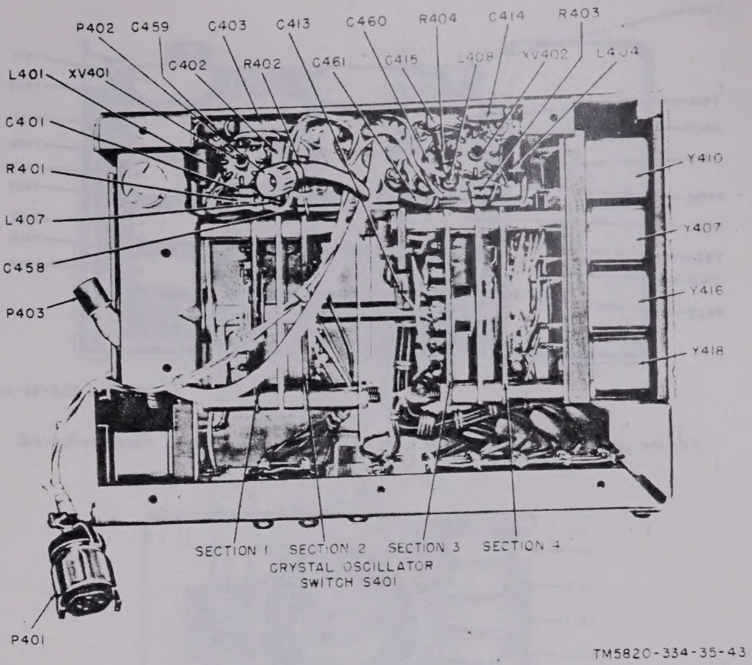

Figure 46. Crystal oscillator subchassis, front view, cover removed.

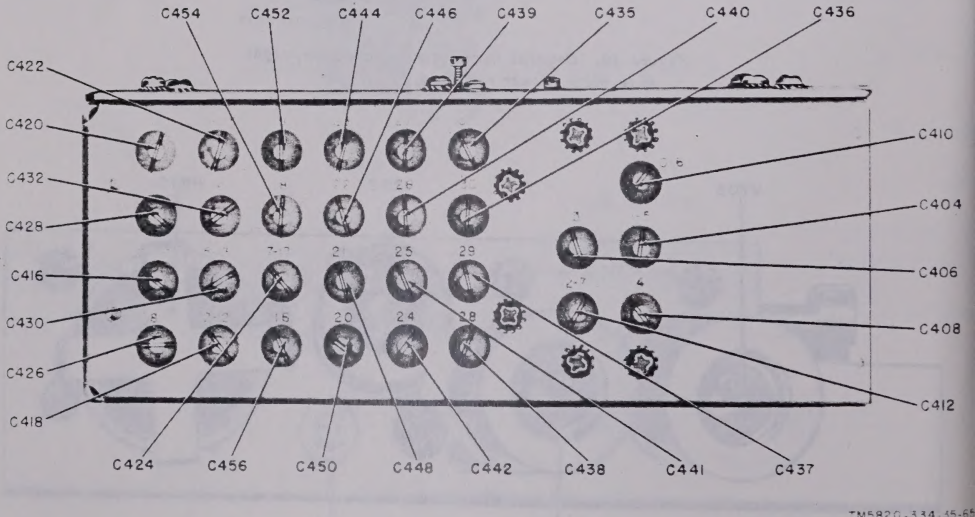

Figure 47. Crystal oscillator subchassis, top view.

b. Oscillator and If. Circuit Selection.

1	2	3	4	5	6	7	8	9
Band (mc)	1st xtal osc crystal freq (mc)	1st xtal osc output freq (mc)	1st variable if. range (mc)	2nd xtal osc crystal freq (mc)	2d xtal osc output freq (mc)	2d variable if. range (mc)	Vfo-mixer range (mc)	Fixed intermediate frequency (kc)
0.5-1	9	9	9.5-10	12	12	2.5-2[a]	2.955-2.455[a]	455
1-2	8	8	9-10	12	12	3-2	3.455-2.455	455
2-3	10	10	12-13	15	15	3-2	3.455-2.455	455
3-4	12.6	12.6	15.6-16.6	6.2	18 6	3-2	3.455-2.455	455
4-5	7	7	11-12	14	14	3-2	3.455-2.455	455
5-6	8	8	13-14	8	16	3-2	3.455-2.455	455
6-7	9	9	15-16	9	18	3-2	3.455-2.455	455
7-8	10	10	17-18	10	20	3-2	3.455-2.455	455
8-9	Not in use after first eight frequency bands.			11	11	3-2	3.455-2.455	455
9-10				12	12	3-2	3.455-2.455	455
10-11				13	13	3-2	3.455-2.455	455
11-12				14	14	2-3	3.455-2.455	455
12-13				15	15	3-2	3.455-2.455	455
13-14				8	16	3-2	3.455-2.455	455
14-15				8.5	17	3-2	3.455-2.455	455
15-16				9	18	3-2	3.455-2.455	455
16-17				9.5	19	3-2	3.455-2.455	455
17-18				10	20	3-2	3.455-2.455	455
18-19				10.5	21	3-2	3.455-2.455	455
19-20				11	22	3-2	3.455-2.455	455
20-21				11.5	23	3-2	3.455-2.455	455
21-22				12	24	3-2	3.455-2.455	455
22-23				12.5	25	3-2	3.455-2.455	455
23-24				13	26	3-2	3.455-2.455	455
24-25				9	27	3-2	3.455-2.455	455
25-26				14	28	3-2	3.455-2.455	455
26-27				9.666	29	3-2	3.455-2.455	455
27-28				10	30	3-2	3.455-2.455	455
28-29				10.333	31	3-2	3.455-2.455	455
29-30				10.666	32	3-2	3.455-2.455	455
30-31				11	33	3-2	3.455-2.455	455
31-32				11.333	34	3-2	3.455-2.455	455

[a] The range of the second variable if. is from 2.5 to 2.0 mc for the 0.5- to 1-mc band, and from 3.0 to 2.0 for all her bands.

a. *Antenna and If. Amplifier Circuit Selection.*

1	2		3	4
Band (mc)	Rf bandswitch S201 (fig. 81)		Range of antenna and rf coils (mc)	Contact of switch S40 (fig. 81)
	Position	Circuit closed between contacts:		
0.5-1	1	8 and 1	0.5-1	0
1-2	2	8 and 2	1-2	1
2-3	3	8 and 3	2-4	2
3-4	3	8 and 3	2-4	3
4-5	4	8 and 5	4-8	4
5-6	4	8 and 5	4-8	5
6-7	4	8 and 5	4-8	6
7-8	4	8 and 5	4-8	7
8-9	5	8 and 6	8-16	8
9-10	5	8 and 6	8-16	9
10-11	5	8 and 6	8-16	10
11-12	5	8 and 6	8-16	11
12-13	5	8 and 6	8-16	12
13-14	5	8 and 6	8-16	13
14-15	5	8 and 6	8-16	14
15-16	5	8 and 6	8-16	15
16-17	6	8 and 7	16-32	16
17-18	6	8 and 7	16-32	17
18-19	6	8 and 7	16-32	18
19-20	6	8 and 7	16-32	19
20-21	6	8 and 7	16-32	20
21-22	6	8 and 7	16-32	21
22-23	6	8 and 7	16-32	22
23-24	6	8 and 7	16-32	23
24-25	6	8 and 7	16-32	24
25-26	6	8 and 7	16-32	25
26-27	6	8 and 7	16-32	26
27-28	6	8 and 7	16-32	27
28-29	6	8 and 7	16-32	28
29-30	6	8 and 7	16-32	29
30-31	6	8 and 7	16-32	30
31-32	6	8 and 7	16-32	31

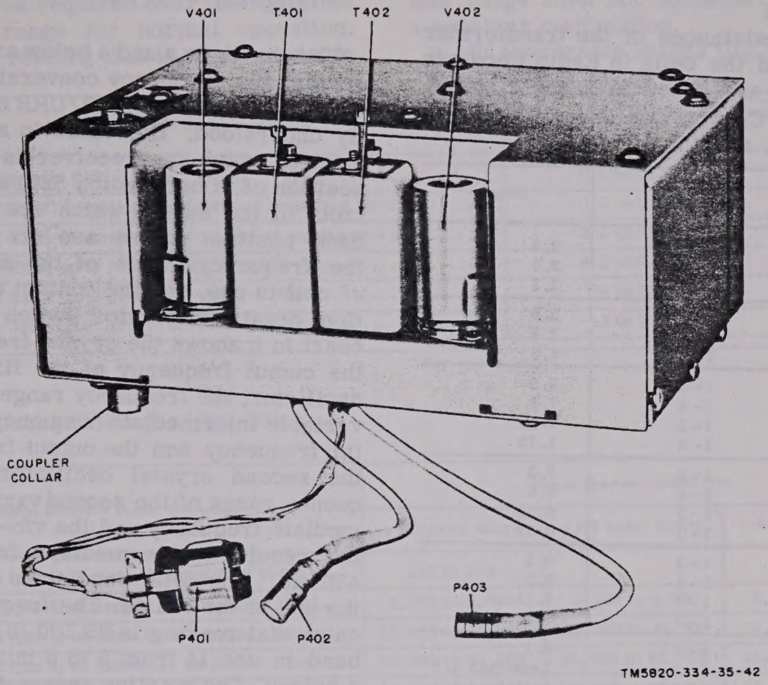

Figure 45. Crystal oscillator subchassis, bottom view.

ariable intermediate frequency is heteroyned with the 2.955-mc signal of the scillator portion of vfo-mixer V801 (colmn 8, *b* below), to produce a fixed internediate frequency of 455 kc at the output f the vfo-mixer (column 9, *b* below). The xample showing use of the charts is given elow:

Frequency of station being received	5.500 mc.
ndicator dial reading	05 500.
MEGACYCLES dial setting	05.
KILOCYCLES dial setting	500.
3and	5-6.
1st crystal oscillator frequency	8 mc.
1st crystal oscillator output frequency	8 mc.
1st variable if.	13.5 mc. (See note 1.)
2d crystal oscillator frequency	8 mc.
2d crystal oscillator output frequency	16 mc.
2d variable if.	2.5 mc. (See note 2.)
Vfo-mixer frequency (oscillator portion)	9.955-mc. (See note 3.)
Fixed intermediate frequency (output of vfo-mixer)	455 kc.

Notes:

1. The first variable if. equals the first crystal oscillator output plus the frequency of the station or signal received.
2. The second variable if. equals the difference frequency between the second crystal oscillator output frequency and the first variable if.
3. The vfo-mixer frequency equals the second variable if. plus the fixed intermediate frequency.

56. Dc Resistances of Transformers and Coils

The dc resistances of the transformer windings and the coils in Radio Receiver R-392/URR are listed in *a* and *b* below.

a. Rf and Crystal Oscillator Subchassis (fig. 43, 44, and 45).

Transformer or coil	Terminals	Ohms
Z201	1-3, 4	2.5
Z207	1-3	2.5
Z213	1-3	2.5
Z202	1-3, 4	3.0
Z208	1-3	1.9
Z214	1-3	1.9
Z203A	1-3	0.2
	1-4	1.6
Z209	1-3	1.15
Z215	1-3	1.15
Z204A	1-3	0.3
	1-4	0.6
Z210	1-3	0.33
Z216	1-3	0.33
Z205A	1-3	0.1
	1-4	0.2
Z211	1-3	0.15
Z217	1-3	0.15
Z206	1,4-3	0.1
Z212	1-3	Less than 0.1
Z218	1-3	Less than 0.1
Z219	1-3	0.16
Z220	1-3	0.16
Z221	1-3	0.16
Z222	1-3	1.7
Z223	1-3	1.7
Z224	1-3	1.7
T401	1-2	Less than 0.1
	3-4	Less than 0.1
T402	1-2	Less than 0.1
	3-4	Less than 0.1

b. Lower Deck Assembly (fig. 36 and 40).

Transformer or coil	Terminals	Ohms
T501	2-9	0.9
	3-10	0.6
T502	2-9	1.2
T503	2-9	1.2
T504	3-10	0.6
T505	3-10	0.6
T601	1-9	1.4
	4-6	1.5
T603	2-3	100
	1-3	100
	4-5	88

57. Rf and Variable If. Conversion Scheme
(fig. 81)

The charts in *a* and *b* below are provide so that the frequency conversion schem of Radio Receiver R-392/URR may be easily understood. The chart in *a* shows th band to which the receiver is tuned, th position of rf bandswitch S201 and the contacts of the switch which are closed fo each position (there are six positions) the frequency range of the antenna an rf coil in use, and the contact of 32-position crystal oscillator switch S401. Th chart in *b* shows the crystal frequency an the output frequency of the first crysta oscillator, the frequency range of the firs variable intermediate frequency, the crystal frequency and the output frequency o the second crystal oscillator, the frequency range of the second variable intermediate frequency and the vfo-mixer, an the resultant intermediate frequency o 455 kc. The following is an example o the use of the charts: The frequency indicator dial reading is 05 500 (5.5 mc). Th band in use is from 5 to 6 mc (column 1 *a* below). The rotating segment of rf bandswitch S201 connects contact 8 to 5 (column 2, *a* below) into the circuit, whic selects the 4- to 8-mc antenna and r coils (column 3, *a* below). The rotatin arm of crystal oscillator switch S401 connects contact 5 (column 4, *a* below) in th circuit, which connects the crystal to b used in the first crystal oscillator (column 2, *b* below). This frequency is 8 mc The output frequency of the first crysta oscillator is 8 mc (column 3, *b* below) which is heterodyned with 5.5 mc in th first mixer (V203) to produce the firs variable intermediate frequency of 13. mc (column 4, *b* below). The crystal frequency of the second crystal oscillator i 8 mc (column 5, *b* below), and its outpu frequency is 16 mc (column 6, *b* below) The 16-mc output of the second crysta oscillator is heterodyned with the 13.5-m signal of the first variable intermediat frequency to produce a 2.5-mc secon variable intermediate frequency in th second mixer (V204) (column 7, *b* below) The 2.5-mc output frequency of the secon at should be required over the specified requency range for normal operation. owever, a reading that is slightly outside this range does not necessarily indicate a receiver malfunction.

a. Rf Subchassis Stages (fig. 43 and 53).

Signal generator output connection	Frequency (mc)	Signal generator output (uv)
ANT binding post E101	0.5 to 32	1 to 4
Test point E201 (control grid of first rf amplifier V201)	0.5 to 32	3 to 7
Test point E202 (control grid of second rf amplifier V202)	0.5 to 32	3 to 7
Test point E203 (grid of first mixer V203)	0.5 to 0.8	25 to 45
Test point E204 (grid of second mixer V204)	8 to 32	20 to 35
Connector J808 (grid (pin 7) of vfo–mixer V801)	3 to 2	40 to 70

b. If. Subchassis Stages (fig. 39).

Signal generator output connection	Signal generator output (uv)		
	2 KC BAND WIDTH	4 KC BAND WIDTH	8 KC BAND WIDTH
Control grid (pin 1) of first if. amplifier V501	130 to 180		
Control grid (pin 1) of second if. amplifier V502	3,300 to 6,000	3,200 to 5,900	2,900 to 5,700
Control grid (pin 1) of third if. amplifier V503	24,000 to 41,000	28,000 to 45,000	22,000 to 38,000
Control grid (pin 1) of fourth if. amplifier V504	25,000 to 40,000	25,000 to 40,000	23,000 to 37,000
Control grid (pin 1) of fifth if. amplifier V505	22,000 to 34,000	22,000 to 32,000	25,000 to 35,000
Control grid (pin 1) of sixth if. amplifier V506	50,000 to 70,000	50,000 to 70,000	50,000 to 70,000

55. Troubleshooting Calibration Oscillator (fig. 50, 51, and 52)

Note. Waveform measurements are performed at fourth and fifth echelons.

If no calibration signal is heard, remove the lower deck assembly for troubleshooting (para 62) and make voltage and resistance measurements in the calibration oscillator (fig. 79). If the reason for failure is not detected by the above checks, troubleshoot with Oscilloscope AN/USM-50.

a. Connect the AN/USM-50 to pin 1 of 200-kc crystal oscillator V702. A waveform similar to the waveform shown in A, figure 52, should be observed. If the waveform is distorted, check crystal Y701, grid resistor R706, capacitors C708, C709, and C706, and screen-grid resistor R707.

Note. Components should be checked by substitution of parts which are known to be good.

b. Connect the AN/USM-50 to pin 5 of V702. A waveform similar to the waveform shown in B, figure 52, should be observed. If the waveform is distorted, check plate resistor R708 and capacitors C711, C703, and C704.

c. Check the waveforms at multivibrator V701 by connecting the AN/USM-50 to the pins indicated in C through F, figure 52. If there is any distortion in the waveforms observed on the AN/USM-50 as compared with those shown in the figure, check all the components in the V701 circuits.

d. Check the waveforms at harmonic amplifier V703A and distorter V703B by connecting the AN/USM-50 to the pins indicated in G through L, figure 52. If there is any distortion in the waveforms observed on the AN/USM-50 as compared with those shown in the figure, check all the components in the V703A and V703B circuits.

53. Checking Oscillator Crystals (fig. 46, 48, and 49)

If an oscillator crystal is suspect, it can be readily checked by substituting a crystal of the same type known to be good.

a. First Crystal Oscillator Crystal Location. The following chart lists the crystal symbol, the fundamental frequency, and the bands in which each crystal in the first crystal oscillator is used. Refer to figure 49 for crystal location.

Crystal symbol	Fundamental frequency (mc)	Bands (mc)
Y401	9	0.5-1 6-7
Y402	8	1-2 5-6
Y403	10	2-3 7-8
Y404	12.6	3-4
Y405	7	4-5

b. Second Crystal Oscillator Crystal Location. The following chart lists the crystal symbol, the fundamental frequency, and the bands in which each crystal in the second crystal oscillator is used. Refer to figures 46 and 48 for crystal location.

Crystal symbol	Fundamental frequency (mc)	Bands (mc)
Y406	12	0.5-1 1-2 9-10 21-22
Y407	15	2-3 12-13
Y408	6.2	3-4
Y409	14	4-5 11-12 25-26
Y410	8	5-6 13-14
Y411	9	6-7 15-16 24-25
Y412	10	7-8 17-18 27-28
Y413	11	8-9 19-20 30-31
Y414	13	10-11 23-24
Y415	8.5	14-15
Y416	11.333	31-32
Y417	10.667	29-30
Y418	10.333	28-29
Y419	9.667	26-27
Y420	12.5	22-23
Y421	11.5	20-21
Y422	10.5	18-19
Y423	9.5	16-17

54. Stage-Gain Charts

The stage-gain charts list the minimur and maximum voltages required at eac of the rf and if. stages of the receiver t produce 2.5 negative dc volts across th diode-load resistor. Use these charts a a standard when troubleshooting to chec the overall gain of the receiver and th gain of each rf or if. stage or group o stages. When the receiver output is low an the tubes test normal, localize the defective stage by checking the signal voltag level of each stage against the chart durin troubleshooting, by signal-substitution, o by measuring the individual stage gain. Obtain the stage-gain readings using Multimeter, Meter ME-26/U connected between jack J615 (fig. 35) and ground (diode load). Connect the ground lead of RF Signal Generator AN/URM-25 to the receive ground, and connect the generator outpu lead through a 0.05-microfared (uf) capacitor to the receiver points indicated in the chart. Use a 50-micromicrofared (uuf) capacitor to connect to the ANT binding post (E101) on the front panel. When checking the 455-kc if. stages, gain access to the injection points by winding 1 turn of a short length of wire around the desired pin of the tube in the stage being tested. Check the output from the AN/URM-25 required to obtain the diode-load reference voltage of 2.5 volts against the figures given in the charts. The lowest figure is the minimum, and the highest is the maximum

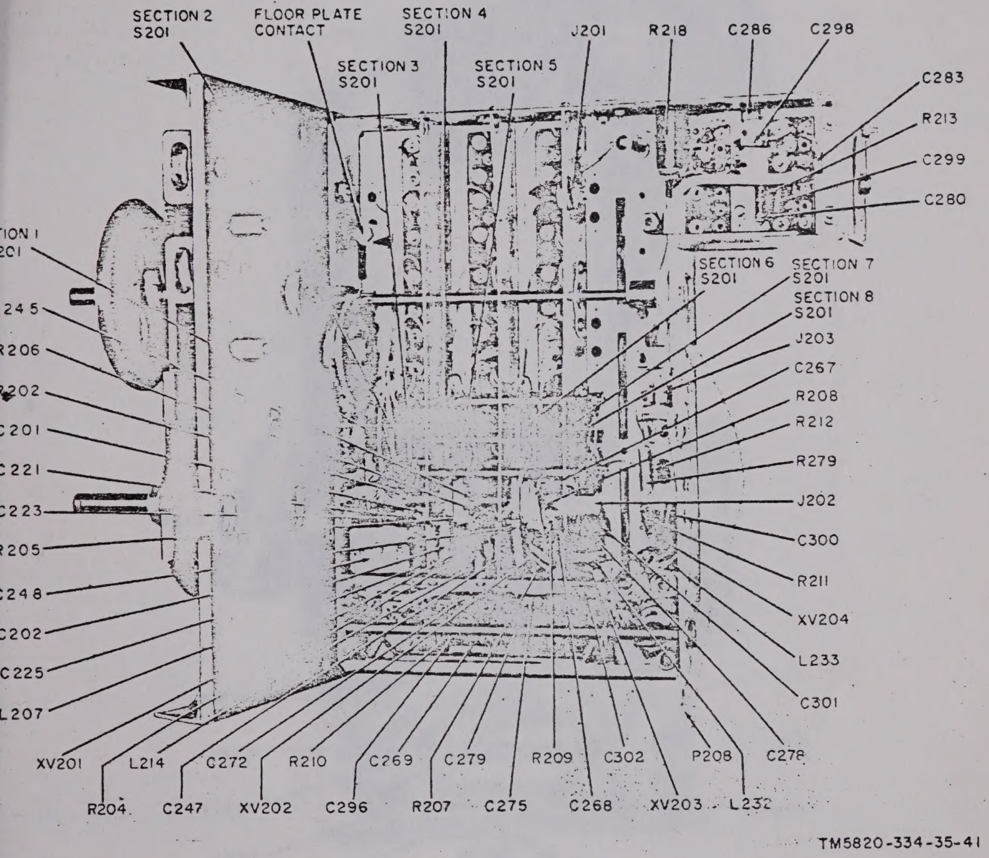

Figure 44. Upper deck assembly, bottom view.

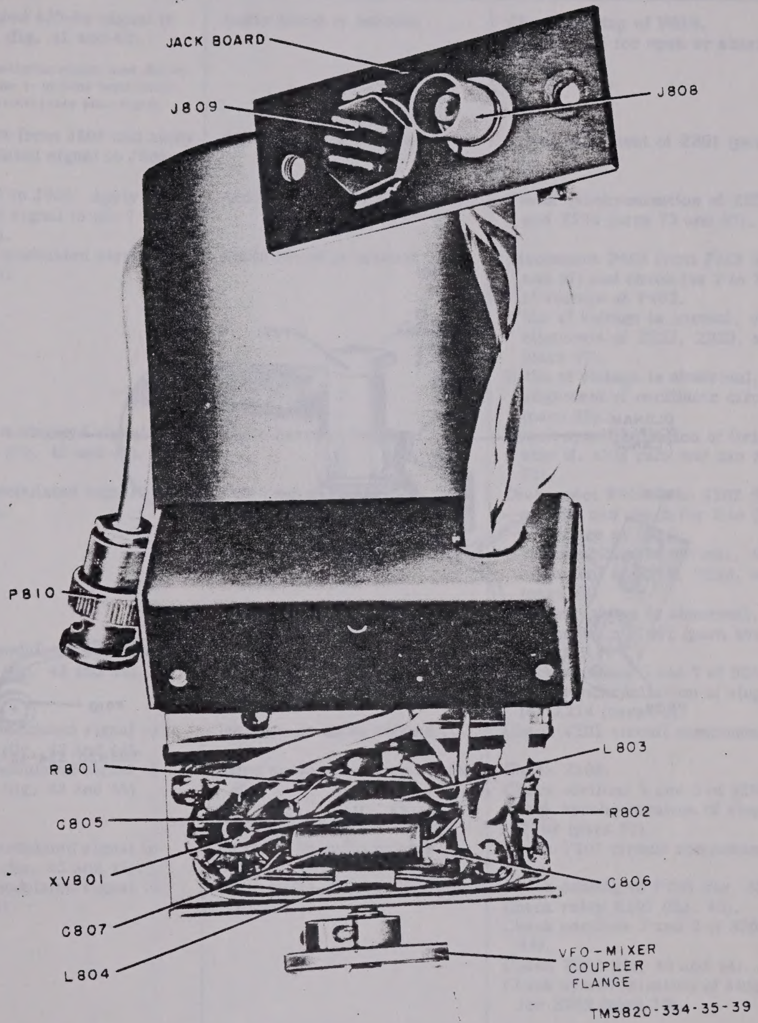

Figure 42. Vfo subchassis, bottom cover removed.

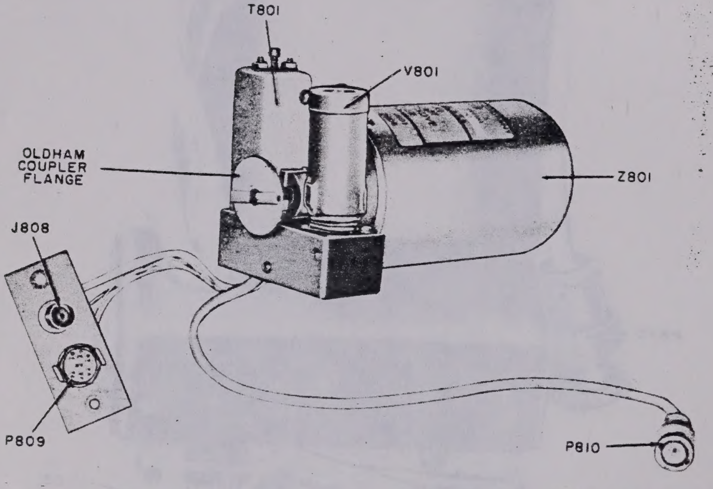

Figure 41. Vfo subchassis.

Vfo, Upper Deck Assembly and Crystal Oscillator Tests
(fig. 41-45 and 57)

Test connection	Normal indication	Corrective measures
Apply a modulated 455-kc signal to pin 5 of V801 (fig. 41 and 42). *Note.* For the remaining steps, tune the receiver to 2 mc in the 1- to 2-mc band (indicator reading of 01+000 (note plus sign)).	Audio heard in headset	Check seating of P810. Check T801 for open or shorted winding. Check C501.
Disconnect P208 from J808 and apply a 2-mc modulated signal to J808 (fig. 41).	Audio heard in headset	Check alignment of Z801 (para 75).
Reconnect P208 to J808. Apply a 2-mc modulated signal to pin 7 of V204 (fig. 43).	Audio heard in headset	Check synchronization of Z222, Z223 and Z224 (para 73 and 87).
Apply a 10-mc modulated signal to E204 (fig. 43).	Audio heard in headset	Disconnect P403 from J203 (fig. 45 and 57) and check for 2 to 3 volts of rf voltage at P403. If the rf voltage is normal, check alignment of Z222, Z223, and Z224 (para 87). If the rf voltage is abnormal, check alignment of oscillator circuits (para 85).
Apply a 10-mc modulated signal to pin 7 of V203 (fig. 43 and 44).	Audio heard in headset	Check synchronization of first variable if. slug rack and can rack (para 73).
Apply a 2-mc modulated signal to E203 (fig. 43).	Audio heard in headset	Disconnect P402 from J202 (fig. 45 and 57) and check for 2 to 3 volts of rf voltage at P402. If the rf voltage is normal, check alignment of Z219, Z220, and Z221 (para 88). If the rf voltage is abnormal, check alignment of T401 (para 86).
Apply a 2-mc modulated signal to pin 5 of V202 (fig. 43 and 44).	Audio heard in headset	Check Z214. Check sections 6 and 7 of S201. Check synchronization of slug rack for Z214 (para 73).
Apply a 2-mc modulated signal to pin 1 of V202 (fig. 43 and 44).	Increase in audio volume ...	Check V202 circuit components.
Apply a 2-mc modulated signal to pin 5 of V201 (fig. 43 and 44).	Same audio volume as in step 8.	Check Z208. Check sections 4 and 5 of S201. Check synchronization of slug rack for Z208 (para 73).
Apply a 2-mc modulated signal to pin 1 of V201 (fig. 43 and 44).	Increase in audio volume ...	Check V201 circuit components.
Apply a 2-mc modulated signal to ANT post E101.	Same audio volume as in step 10.	Check seating of P206 (fig. 43). Check relay K101 (fig. 43). Check sections 1 and 2 of S201 (fig. 44). Check Z202 (fig. 43 and 44). Check synchronization of slug rack for Z202 (para 73).

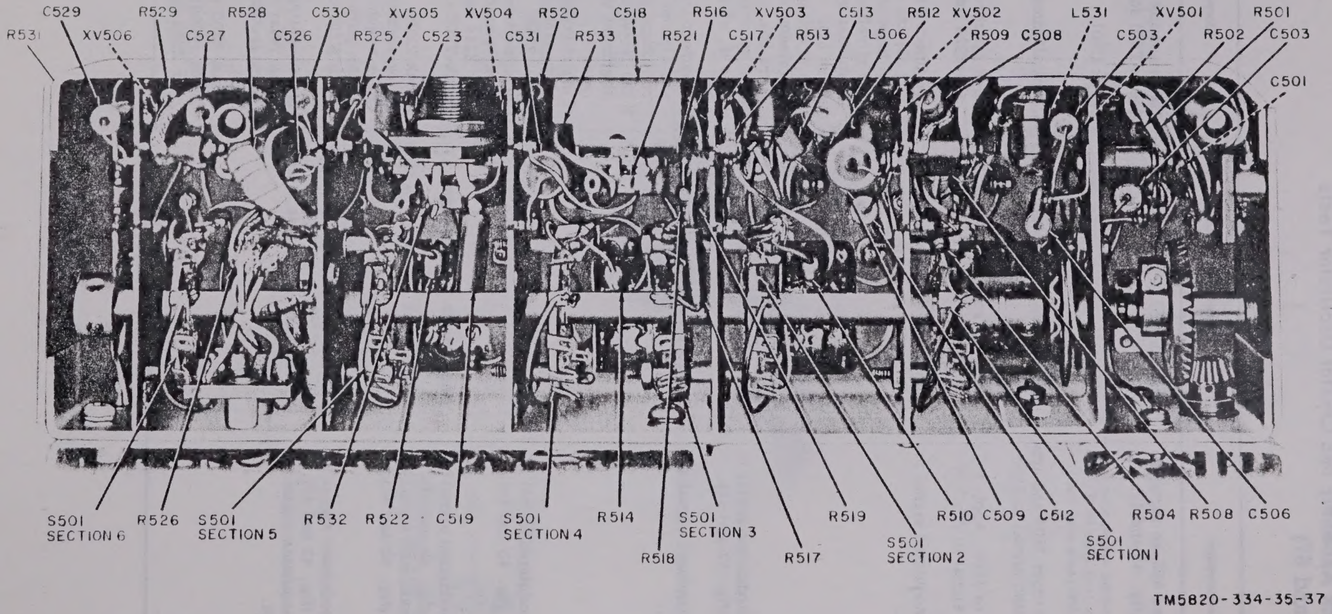

Figure 40. If. subchassis, bottom view.

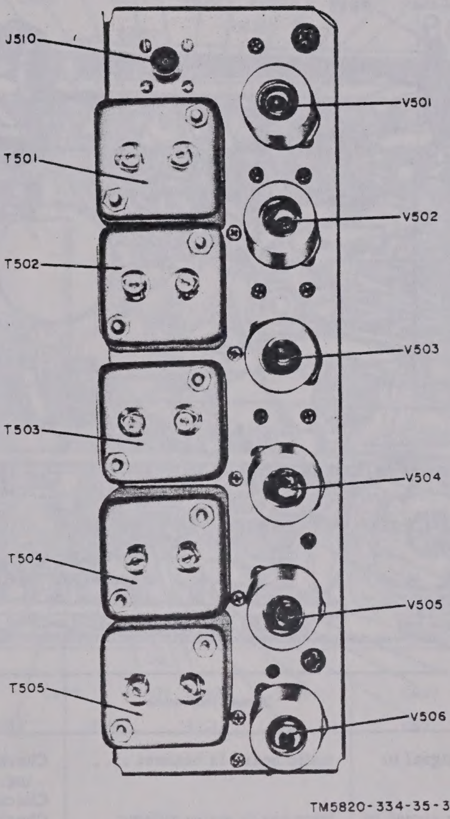

Figure 39. If. subchassis, top view.

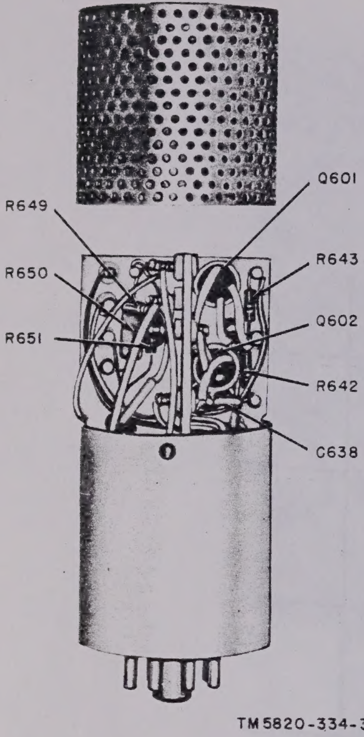

Figure 37. Audio module, left side view, cover removed.

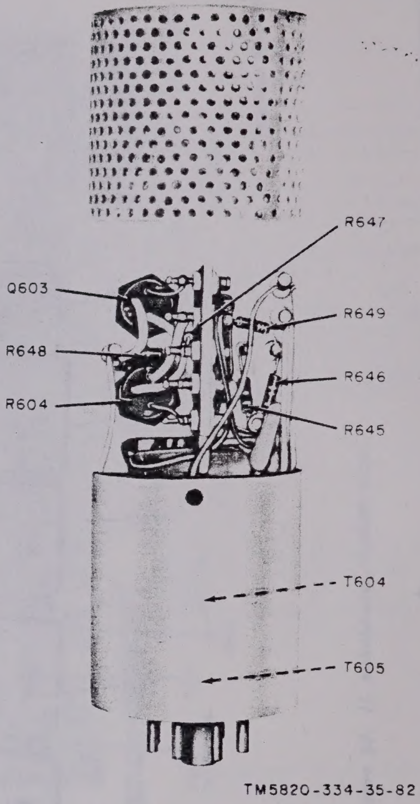

Figure 38. Audio module, right side view, cover removed.

51. If. Subchassis Tests
(fig. 39 and 40)

Step	Test connection	Normal indication	Corrective measures
1	Apply a modulated 455-kc signal to pin 5 of V506.	Audio heard in headset	Check T601 for open or shorted winding. Check C602.
2	Apply the modulated 455-kc signal to pin 1 of V506.	Increase in audio volume ...	Check C529 for open.
3	Make the following settings on the receiver: Function switch to NORMAL. AGC switch to OFF. RF GAIN SQUELCH THRESH control fully clockwise. BAND WIDTH switch to 4 KC. Apply the modulated 455-kc signal first to pin 5 and then to pin 1 of V505, V504, V503, V502, and V501, in that order.	Audio volume should be approximately the same for all test connections.	Check the components of any stage that does not provide a normal indication.

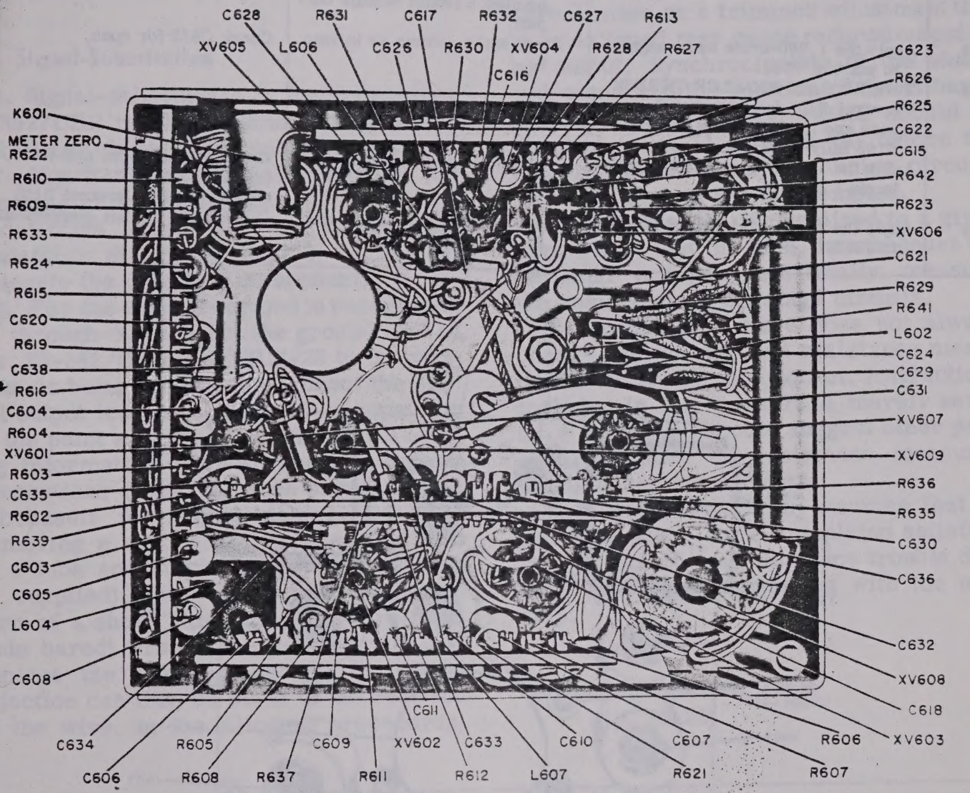

Figure 36. Audio subchassis, bottom view.

Step	Test connection	Normal indication	Corrective measures
4	Apply a 1,000-cycle audio signal first to pin 4 and then to pin 8 of the audio module.	Low-volume tone in headset. .	Check headset. Check seating of P113. Check T603. Check C628 for short.
5	Apply a 1,000-cycle audio signal to pin 7 of V607.	Increase in audio volume	Check C627.
6	Apply the 1,000-cycle audio signal to pin 1 of V607.	Audio volume slightly less than in step 3 (V608 output) or step 5 (audio module output).	Check R627, R628, and R630. Check C623.
7	Apply the 1,000-cycle audio signal to pin 5 of V606.	Same audio volume as in step 6.	Check C623 for open.
8	Turn RF GAIN SQUELCH THRESH control R105 fully counterclockwise and turn AF GAIN control R103 fully clockwise.		
	Apply the 1,000-cycle audio signal to pin 1 of V606.	Increase in audio volume	Check R623, R625, and R626. Check C622 and C637. Check AF GAIN control R103.
9	Apply the 1,000-cycle audio signal to J615.	Same audio volume as in step 8.	Check V603 circuit components.

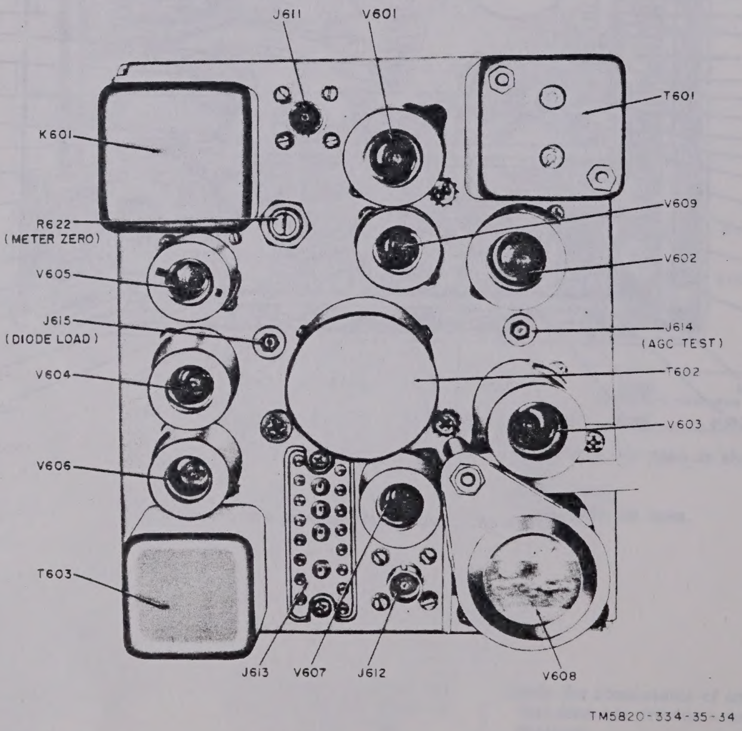

Figure 35. Audio subchassis, top view.

easurement with the value given in fig- e 20. If a measurement is too low, re- erse the meter leads and measure again. ransistors may be checked by substi- tion. Be careful when soldering transis- r leads (para 58).

Caution: **Use a TS-352/U on the R x 00 range for resistance measurements. lower range may damage the transis- rs.**

9. Signal-Substitution

a. Signal-substitution in Radio Receiver -392/URR requires Audio Oscillator TS- 2/U for checking the audio circuits and F Signal Generator AN/URM-25 for ecking rf and if. circuits. After locating defective stage, use the voltage and esistance diagrams (fig. 78, 79, and 80) locate the defective component.

b. For the tests described in paragraphs through 52, connect the ground lead of e TS-382/U or AN/URM-25 to the sub- assis being tested, and connect the sig- al output lead, through a 0.05-uf capacitor the point specified. Use the bench test- g information (para 41) and take proper recautions (para 42) when preparing the ubchassis for signal tracing. To avoid emoving a subchassis to inject a signal t a tube socket pin (where no test jack s supplied), remove the tube; wind one urn of a short, thin, insulated wire (both nds bared) around the desired pin, and eplace the tube. Connection for signal njection can then be made to the bare end f the wire. In the following procedures, maintain the same signal generator level for each test connection.

c. Note the volume and listen for distortion from the speaker or headset at various steps in the signal-substitution procedure. Work back from the output to the input stages. If possible, compare results with a receiver known to be in good condition.

d. A tuning shaft which is out of synchronization or a trimmer adjustment that is misaligned may cause reduced output or no output. Synchronization of the shafts and cams and the position of the rf bandswitch and the crystal switch should be checked (para 71 through 74) before the adjustment of individual tuning circuits (para 83 through 90) is attempted.

e. When trouble is localized to a given stage, first test the tube, then measure the terminal voltages, and finally, measure the resistance of the stage circuits.

f. Trouble in a stage does not always change the voltage and resistance measurements at the tube socket. Instructions included in this paragraph merely serve as a guide, and should suggest other procedures, such as resistance measurements of individual parts.

g. In each step, it is assumed that all previous steps were completed satisfactorily. Isolate and clear any trouble discovered before proceeding with the next step.

50. Audio Subchassis Tests

(fig. 35-38)

Step	Test connection	Normal indication	Corrective measures
1	Apply a 1,000-cycle audio signal first to pin 4 and then to pin 8 of V608. *Note.* Steps 2 and 3 do not apply to receivers using an audio module.	Low-volume tone in headset..	Check headset. Check seating of P113. Check T603. Check C628 for short.
2	Apply the 1,000-cycle audio signal first to pin 1 and then to pin 3 of V608.	Increase in audio volume. Volume is the same for both pin test connections.	Check C626 and C627 for leakage. Check R631 and R632.
3	Apply the 1,000-cycle audio signal first to pin 5 and then to pin 7 of V607. *Note.* Steps 4 and 5 apply only to receivers using an audio module.	Audio volume the same as in step 2. Volume is the same for both pin test connections.	Check C626 and C627.

Item	Indication	Probable trouble	Procedure
6	No beat note during reception when BFO switch is turned to ON and BFO PITCH control is rotated.	Faulty bfo circuit	Check BFO switch and BFO PITCH control C101.
7	No calibration beat note when AGC switch is set at CAL. The beat note does not appear at approximately every 100-kc point as the KILOCYCLES control is turned.	Defective calibration-oscillator circuit, or vfo-mixer stage.	Check crystal Y701. Check calibration-oscillator and vfo circuits
8	Weak signal	Weak tubes or low voltage ...	Check input voltage. Check gain of each stage to localize trouble (par 54). If the fault is not located by t above tests, check tuned circuit alignment.
9	Noisy receiver	Noisy antenna location. Poor or loose connections of parts or terminals. A noisy tube.	Short circuit antenna to ground. A considerable decrease in noise indicates a noisy signal from the antenna. Use an insulated prod to tap each tube. If tapping a tube causes mor noise in the output, replace that tube. Tap the parts. Move terminals slightly and listen for noisy output. Suc noise indicates either a poor solde connection or an intermitten part.
10	Receiver output noisy when controls are operated.	Dirty switch contacts. Poor contact at rotor of control.	Clean switch contacts. Clean or replace control.
11	Distorted signal	Weak tube. Incorrect voltage on tube. Leaky coupling in audio stage. No agc voltage (receiver blocks with a strong signal).	Check for leaky coupling capacitor. Check agc voltage. If agc voltage is low or zero, check agc circuits
12	With the function switch at SQ, RF GAIN SQUELCH THRESH control at a low gain setting or at extreme counterclockwise position, noise is heard between received signal points on the dial as the KILOCYCLES control is turned.	Faulty squelch circuit......	If no click is heard as KILOCYCLES control is rotated, check relay K6 for a mechanical bind or an open winding.
13	Receiver normal on 8- to 32-mc bands but inoperative on 0.5- to 8-mc bands.	Defective 1st mixer or 1st crystal oscillator stage.	Check 1st mixer by voltage and resistance measurements (fig. 78). Check 1st crystal oscillator by voltage and resistance measurements (fig. 78).
14	Receiver inoperative on a band.....	Defective crystal in 1st or 2d crystal oscillator stage.	Check appropriate crystal by substitution (para 53).

48. Voltage and Resistance Measurements

Voltage and resistance diagrams for the various subchassis of the receiver are shown in figures 78, 79, and 80. These diagrams show the voltages and resistances which should be obtained at the tube socket pins. If a reading is different from the reading given in the diagrams (outside of reasonable tolerance limits), the amount of variance should be noted and used to aid in determining which part is at fault. For example, if 100,000-ohm resistanc is indicated at a given tube socket pin o a diagram, and the actual indication on th meter is 30,000 ohms, the circuit diagran of the subchassis should be examined fo the presence of a component in the circui under test which could, if defective, account for the incorrect reading (such as shorted bypass capacitor in the circui under test). To troubleshoot a defectiv audio module, check each circuit component with an ohmmeter and compare th

CAL. Starting with the lowest detent (extreme counterclockwise) position of the MEGACYCLES control, turn the control clockwise to each detent position in succession. Adjust the BFO PITCH control to obtain a signal in the headset at each detent position. If no audible signal is heard in a detent position, trouble in the contact of the rf bandswitch or the crystal switch is indicated.

(2) The synchronization of the tuning shafts can be quickly checked as follows:

(a) Set the frequency indicator dial so that the first two digits are zeros and the last three digits indicate 500.

(b) Set the function switch at NORMAL and the AGC switch at CAL.

(c) Turn the RF GAIN SQUELCH THRESH control clockwise until an indication is obtained on the CARRIER LEVEL meter.

(d) Remove the receiver from its case (para 60) and raise the 0.5- to 1-mc rf slug rack (fig. 59) slightly by hand; the indication on the CARRIER LEVEL meter should decrease.

(e) Depress the 0.5- to 1-mc rf slug rack slightly by hand; the indication on the meter should decrease. If the meter indication increases when the slug rack is either raised or depressed, the camshaft is out of synchronization or alignment (para 71).

(f) Repeat procedures (*a*) through (*e*) above for each rf slug rack, adjusting the MEGACYCLES control so that the first two digits on the frequency indicator dial indicates a frequency within the band covered by the slug rack being checked.

47. Troubleshooting Chart

The following chart will aid in locating defective components in the radio receiver. This chart lists the symptoms which the repairman observes, either visually or aurally, while making simple tests. The chart also shows how to localize trouble quickly to the defective audio, if., or rf section. The signal-substitution tests outlined in paragraphs 49 through 53 may be used to supplement the tests in this chart. Once the trouble has been localized to a stage, a tube check and voltage and resistance measurements of the stage should isolate the defective part.

em	Indication	Probable trouble	Procedure
1	When function switch is in NORMAL position, receiver fails to operate and dial lamp does not light. (DIAL DIM switch at ON).	Open LINE 5 AMP fuse (F102) on front panel of receiver.	Replace fuse. If it blows again, check filament circuits for shorts (para 45). Check power connections.
2	Dial lamp lights, but CARRIER LEVEL meter pointer does not deflect (AGC switch set to ON). No reception.	No plate supply voltage. Open PLATE 1/2 AMP fuse (F101) on front panel of receiver.	Replace fuse. If it blows again, test plate circuit for shorts (para 45).
3	No receiver output. CARRIER LEVEL meter pointer rises and dips as KILOCYCLES control is turned.	Defective signal circuits following 2d if. amplifier stage.	Connect headphones with a 0.1-uf capacitor across grid circuits and plate circuits of successive audio stages to localize defective stage. If the audio stages check out, test if. amplifiers following second if. amplifier by signal-substitution (para 51).
4	Some noise in output; no signal reception.	Faulty rf or if. amplifier stage.	Test rf or if. amplifier stages by signal-substitution (para 51 and 52).
5	Hiss in output; no signal reception . .	Faulty mixer, oscillator, or rf stages.	Test mixer, rf, and crystal oscillator stages by signal-substitution (para 52).

45. Checking Plate and Filament Circuits for Shorts

Caution: **In receivers that use an audio module, remove the audio module before checking the plate or filament circuits.**

a. Purpose of Tests. To prevent damage to a receiver brought in for repair, always check the resistance of the plate and filament circuits before applying power to the equipment. Repeated burning out of PLATE 1/2 AMP fuse (F101) is an indication of a short in the plate circuits. Repeated burning out of LINE 5 AMP fuse (F102) is an indication of a short in the filament or associated circuits (relays and oven heater).

b. Conditions of Tests. To prepare
the short circuit tests, perform the f
lowing steps:

(1) Remove the receiver from its ca
(para 60).

(2) Remove the cable from the POW
INPUT-TRANS CONT receptac

c. Measurements. Make the resistan
measurements indicated in the followi
chart. A resistance measurement is ma
from either contact of a fuseholder
ground with a good fuse in place. If a
normal results are obtained, take the co
rective measures outlined. When a faul
part is found, repair the trouble befo
applying power to the receiver.

Action	Point of measurement	Normal indication	Corrective measures
Turn function switch to STAND BY.	PLATE 1/2 AMP fuse (F101)...	Infinity	Check af, vfo, and crystal oscillator plate circuits f shorts.
Turn BFO switch ON......	PLATE 1/2 AMP fuse (F101)...	Infinity	Check BFO plate circuit fo shorts.
Turn function switch to NORMAL.	PLATE 1/2 AMP fuse (F101)...	2,300 ohms	Check the plate circuits not checked in the above procedure.
Turn function switch to STAND BY, BFO switch OFF, DIAL DIM switch OFF.	LINE 5 AMP fuse (F102).......	2.6 ohms	Check all filament circuits, antenna relay K101, brea relay K602, crystal oven 701, and section 1 of swit S104.
Turn DIAL DIM switch ON. .	LINE 5 AMP fuse (F102).......	2.6 ohms	Check the dial light circuit.

46. Operational Test

a. Operate the equipment as described in the equipment performance checklist (TM 11-5820-334-20). This checklist is important because it frequently aids in sectionalizing the trouble without the need for further testing. Check for overheated parts, faulty controls, and intermittent operation. Note the CARRIER LEVEL meter indication. A normal meter indication usually indicates satisfactory operation of the agc circuit and all stages up to and including the second if. amplifier.

b. To check the audio and if. stages quickly, connect a headset to one of the AUDIO receptacles on the front panel. Turn the function switch to NORMAL and the AGC switch to ON. Starting at the 8
position of the BAND WIDTH switch,
the switch, in turn, to the 4 KC and 2
position. If the volume of the rushing so
heard in the headset decreases noticea
with each lower setting of the BAND WID
switch, the if. and audio stages are pr
ably operating normally.

c. The calibration-oscillator signal
be used as a convenient means of quic
localizing trouble in the receiver as f
lows.

(1) To check the synchronization of
rf bandswitch and the cryst
switch, connect a headset to on
the AUDIO receptacles on the fr
panel. Set the function switch
NORMAL and the AGC switch

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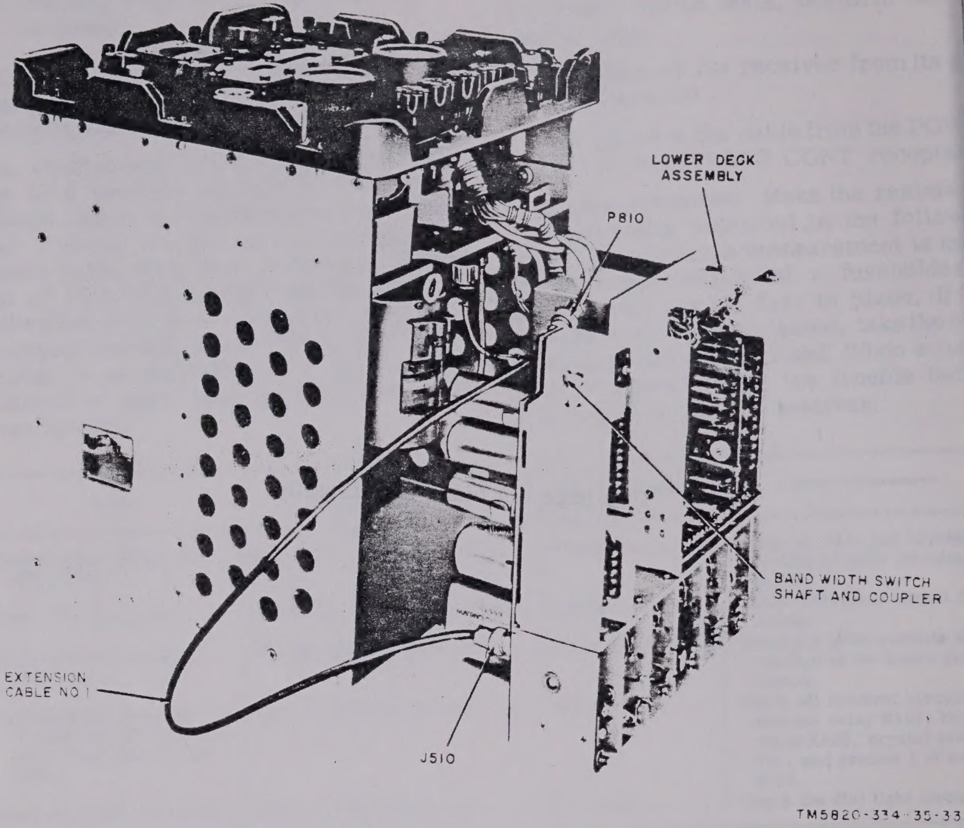

Figure 32. Bench test, lower deck assembly removed.

Check for short circuits (para 45) when a blown fuse is found.

e. MEGACYCLES and KILOCYCLES controls for rough operation or binding. Roughness of tuning mechanism operation indicates need for cleaning and lubrication (para 69 and 70) or a damaged tuning system.

f. Switches and controls for ease of operation.

44. Test Equipment Required

The following chart lists test equipment required for troubleshooting Radio Receiver R-392/URR. The chart also list the associated technical manuals for th test equipment.

Test equipment	Technical manual
Audio Oscillator TS-382/U	TM 11-2684
Multimeter, Meter ME-26/U	TM 11-6625-200-12
Multimeter, TS-352/U	TM 11-5527
Oscilloscope AN/USM-50	TM 11-5129
Rf Signal Generator AN/URM-25	TM 11-5551
Test Set, Electron Tube TV-7/U	TM 11-6625-274-12

Subchassis or assembly	Extension cable No.	Connect between	Fig. No.
Rf			
Rf to front panel	3	J206-P106	54
Rf to crystal oscillator	4	J201-P401	57
Crystal oscillator to rf	1A	P402-J202	57
Vfo to rf	1A	J808-P208	53
Rf to front panel	1A	P206-J106	54
Crystal oscillator to rf	1A	P402-J202	57
Crystal oscillator			
Crystal oscillator to rf	4	P401-J201	57
Crystal oscillator to rf	1A	P403-J203	57
Crystal oscillator to rf	1A	P402-J202	57
Vfo			
Vfo to front panel	4	J809-P109	53
Vfo to rf	1A	J808-P208	53
Vfo to if.	1	P810-J510	53
Lower deck assembly			
Af to front panel	2	J613-P113	53
Front panel to af	1	P111-J611	53
Front panel to af	1	P112-J612	53
Vfo to if.	1	P810-J510	53

2. General Precautions

Whenever a receiver is to be serviced, bserve the following precautions.

a. Be sure that the receiver is discon- ected from the power source or is turned ff before contacting exposed circuits or hanging connections.

b. After removal of a subchassis, do not urn the shafts or tuning controls unless it s necessary for troubleshooting or ad- ustment. Careful handling may eliminate he need for synchronization procedures. Vhen removing a subchassis, note the po- ition of the front panel controls, because control may be turned during servicing.

c. Careless replacement of parts often roduces new faults. To prevent further lamage, note the following precautions.

(1) Note the position of the leads before unsoldering a part. If the part has a number of connections, tag each of its leads.

(2) Be careful not to damage other leads while pulling or pushing them out of the way.

(3) Do not allow drops of solder to fall into the receiver; they may cause short circuits.

d. In receivers using the transistorized audio module in the audio subchassis, do not troubleshoot by shorting various points to ground and listening for a *click;* transistors may become permanently damaged.

43. Visual Inspection

When a receiver is brought in for a check or repairs, remove the receiver from its case (para 60) and in addition to the items listed for organizational maintenance (TM 11-5820-334-20), inspect the following:

a. Resistors and insulation for signs of overheating. Check for wax leakage and discoloration of components.

b. Tube sockets, plugs, and other components for broken connections.

c. Bare wires for shorts to chassis or adjoining wires.

d. Fuses for correct rating and type.

CHAPTER 2

TROUBLESHOOTING

Note. All troubleshooting may be performed by third echelon maintenance personnel unless otherwise no

40. Troubleshooting Procedures

a. General. The first step in servicing a defective receiver is to sectionalize the fault. Sectionalization consists of tracing the fault to the subchassis responsible for the abnormal operation of the receiver. The second step is to localize the fault. Localization means tracing the fault to the malfunctioning circuit in the subchassis. Finally, the defective part is isolated by voltage and resistance measurements.

b. Sectionalization. Listed below is a group of tests arranged to aid in locating the defect to a subchassis.

(1) *Visual inspection.* The purpose of visual inspection is to locate faults without circuit tests or measurements.

(2) *Operational tests.* Operational tests (para 46) frequently indicate the general location of trouble. In many instances, the tests will help in determining the exact nature of the fault.

(3) *Checking plate and filament circuits for shorts.* These measurements (para 45) prevent further damage to the receiver from possible short circuits.

c. Localization. The charts and tests listed below will aid in locating the defective circuit.

(1) *Troubleshooting chart.* The troubleshooting chart (para 47) presents a systematic method of locating malfunctioning circuits.

(2) *Signal substitution.* Signal-substitution (para 49), when used in conjunction with the troubleshooting chart, provides a method of localizing trouble to a stage.

(3) *Stage-gain charts.* These charts (para 54) are helpful in localizing obscure, hard-to-find troubles.

d. Isolation. The defective componen usually located by voltage and resistan measurements. Voltage and resistan charts (fig. 78, 79, and 80), and paragra 56 will aid in locating the defective cor ponent. The resistor and capacitor col codes are given in figure 76 and 77.

Note. Intermittents. In all these tests, the po sibility of intermittents should not be overlook This type of trouble may be made to appear by ta ping or jarring the subchassis or parts under te It is possible that the trouble is not in the recei but in the installation (mounting, antenna, grou connection, vehicle, or other associated equipme

41. Bench Testing
(fig. 32, 33, and 34)

a. When a cause of equipment failure ha been sectionalized to a subchassis, a benc test of the faulty subchassis and use of th troubleshooting chart may be required locate the trouble. Because the undersid of the subchassis are not accessible fo troubleshooting when the subchassis ar mounted in the receiver, it may be necessary to remove the subchassis. Mo bench testing can be performed by removing the lower deck assembly from the receiver and connecting extension cable No. between P810 from the vfo subchassis an J510 on the if. subchassis (fig. 32). may sometimes be necessary to remov the subchassis under test and connect the to the receiver circuits by the use of extension cables. Directions for the fabr cation of extension cables are given figures 33 and 34.

b. To prepare a subchassis for benc testing, remove it from the receiver according to the instructions contained paragraphs 58 through 65. Connect the extension cables, if necessary, between th receiver and subchassis according to th following chart.

that the teeth of lost motion gear 0272(B) are engaged by spur gear 0273.

. *Differential Output.*

(1) Rotation of the KILOCYCLES control turns spur gear 0318, which drives gear 0317(G). Rotation of the MEGACYCLES control turns gear 0324, which drives gear 0317(H). As gear 0317(G) is rotated, spur gear 0317(A) is driven which, in turn, drives gear 0317(B), spur gear 0317(C), gear 0317(E), and differential output gear 0317(J). Shaft 0317(D) does not turn as gear 0317(G) is rotated, but the gears mounted on it rotate, disk 0317(F) remains stationary, and gear 0317(H) is not affected. When gear 0317(H) is rotated, shaft 0317(D) is rotated (but not about its own axis). As shaft 0317(D) rotates, spur gear 0317(C) drives gear 0317(E), which rotates the differential output shaft and differential output gear 0317(J).

(2) The differential output gear drives the 2- to 4-mc, 4- to 8-mc, 8- to 16-mc, and the 16- to 32-mc rf slug racks through a gear train composed of gear 0308, antibacklash gear 0311-0309, antibacklash gear 0309-0310, gear 0312, gear 0316, antibacklash gear 0280, spur gear 0281, antibacklash gear 0282, spur gear 0283, and antibacklash gear 0269-0270.

(3) The MEGACYCLES control must set the circuit elements at an exact position for each band of frequency coverage. This requirement is met with the MEGACYCLES control detent. Detent disk 0317(F) has three notches spaced equally around its perimeter; the disk is rotated by gear 0317(H) and antibacklash gear 0324. An L-shaped bracket, made of spring metal, presses against the disk and produces an effective stop at each notch.

(2) As the KILOCYCLES control is turned, antibacklash gear 0329-0330 rotates a group of gears comprised of clutch assembly 0342, bevel and spur gear 0336, and bevel gear 0338, which drive the kilocycle counter (the last three digits) on frequency indicator M201.

(3) The DIAL LOCK control engages a disk mounted on antibacklash gear 0329-0330 and is used to lock the KILOCYCLES control. When the DIAL ZERO control is turned clockwise, it engages clutch assembly 0342 which in turn, disengages the kilocycle counter from the KILOCYCLES control.

(4) Spur gear 0318 rotates with vfo drive shaft 0331 and drives spur gear 0317(G); 0317(G) is the kilocycle input gear to the differential. The kilocycle input to the differential gear drives the 0.5- to 1-mc rf slug rack through a group of gears comprised of antibacklash gear 0319 (51), spur gear 0319 (30) and gear 0346 (72). The 0.5- to 1-mc rf cam is attached to one end of the 0.5- to 1-mc rf camshaft. A roller, attached to the slug rack, rides on the cam and moves the slug rack which contains the tuning slugs of Z201, Z207, and Z213. Spur gear 0346 (54) is mounted on the 0.5- to 1-mc rf camshaft and drives antibacklash gear 0267-0268 which, in turn, drives the 1- to 2-mc cam and the second variable if. cam (3-2 mc). The 1- to 2-mc cam moves the 1- to 2- mc rf slug rack (Z202, Z208, and Z214) and the second variable if. cam moves the 3- to 2-mc if. slug rack (Z222, Z223, and Z224).

(5) The 9- to 18-mc variable if. can rack is moved when the KILOCYCLES control is rotated. Gear 0318, on the vfo shaft, drives 0317 (G), spur gear 0343, gear assembly 0345, and antibacklash gear 0296-0297, which rotates the first variable if. can rack cam. The first variable if. can is moved by cam.

b. MEGACYCLES Control.

(1) The MEGACYCLES control tu shaft 0332 which is limited to 1 1/2 turns by a 10-1/2-turn st Spur gear 0327, antibacklash ge 0324, and spur gear 0326 a mounted on shaft 0332.

(2) As the MEGACYCLES control turned, spur gear 0327 drives group of gears which moves megacycle counter (the first t digits) on frequency indicat M201. The group of gears is co prised of spur gears 0339, 03 and 0341 (60), and bevel gears 0 (24), and 0337.

(3) As MEGACYCLES shaft 0332 rotated, spur gear 0326 drives g assembly 0304, gear assem 0305, and gear 0306. Gear 0 turns the first variable if. c which moves the 9- to 18-mc va able if. slug rack.

(4) Gear 0324 drives the megacyc input to differential gear 0317(The megacycle input to differen gear 0317(H), rotates the 32-po tion crystal oscillator switch the 6-position rf bandswit through a system of gears. The position crystal oscillator swit S401, is driven through spur ge 0321, 0323, 0298, 0299, and 03 shaft 0295, spur gear 0350, Oldham coupler, and worm 03 Worm 0349 drives worm wh 0348 which drives the 32-posit crystal switch. The Oldham co ler corrects for misalignment tween shaft 0295 and the wo shaft. The 6-position rf bandswit S201, is driven through spur g 0350 on shaft 0295, and drives Geneva system and overtra coupler and spur gears 0273 0274. Gear 0272(A), on the Gen system and overtravel coupl rotates continuously as the ME ACYCLES control is turned; ho ever, spur gears 0273 and 0274 driven only during the interv

iven by the KILOCYCLES control to keep
ese circuits in alignment during tuning.

. Detailed Analysis of Tuning System (fig. 31)

The mechanical schematic diagram of
e tuning system illustrates the mechani-
l parts and their relationship to each
her. The placement of the various
echanical components of the tuning sys-
echanical components of the tuning sys-
m has been illustrated for clarity and
sociation with related text matter and
es not necessarily indicate the exact
ysical placement within the equipment.
ears that are physically mounted together
e shown as operating from a common
aft to more clearly illustrate the
echanical action involved. The numbers
ich appear on the gears in the diagram
dicate the number of teeth. The reference
mbol callouts (example; 0324, 0297) for
ars and shafts are used for identification
purposes in the related text. When gears that are physically mounted together are identified with a single reference symbol, the teeth number follows the reference symbol to distinguish between gears (example; 0319 (51), 0319 (30)). The differential and the Geneva system and overtravel coupler components are individually identified with a letter suffix on the reference symbol (example; 0317 (A), 0317 (B)).

a. *KILOCYCLES Control.*

(1) As the KILOCYCLES control is turned, variable-frequency oscillator drive shaft 0331 is rotated. Antibacklash gear 0329-0330, spur gear 0318, a 10-1/2-turn stop, and an Oldham coupler are mounted on the shaft. The rotation of 0331 is limited to 10-1/2 turns by the 10-1/2-turn stop. The Oldham coupler corrects misalignment between the vfo drive shaft and the vfo tuning shaft.

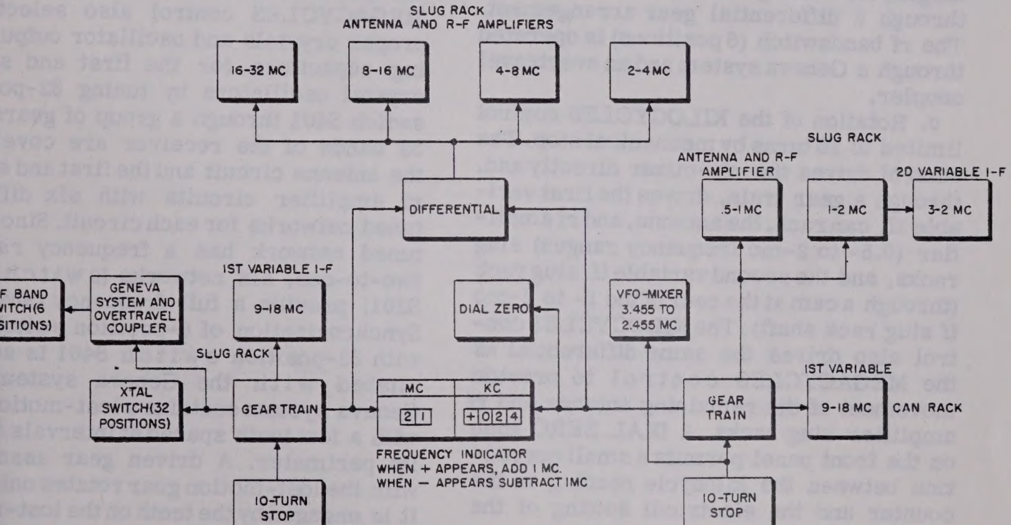

Figure 29. Mechanical tuning system, block diagram.

Section III. ANALYSIS OF MECHANICAL TUNING SYSTEM

37. General Principles of Operation
(fig. 29)

a. The tuning controls of the receiver vary the permeability-tuning and switch components to provide continuous tuning over a range of 0.5 to 32 mc in 32 bands. Each band is tuned over a 1-mc range except for the first band, which is from 0.5 to 1 mc. The frequency is indicated on a counter-type dial.

b. Rotation of the MEGACYCLES control is limited to 10 turns (three detent positions to a turn) by a mechanical stop. As the control is turned, the first variable if. is varied, through a gear train, from 9 to 18 mc for the tuning range of 0.5 to 8 mc; the first variable if. is electrically disabled on other ranges. At the same time, the switches in the first and second crystal oscillators are rotated through 32 positions and the antenna and rf amplifier slug rack positions are changed (to obtain the megacycle change in electrical tuning) through a differential gear arrangement. The rf bandswitch (6 positions) is operated through a Geneva system and an overtravel coupler.

c. Rotation of the KILOCYCLES control limited to 10 turns by mechanical stop. The control drives the vfo-mixer directly and, through a gear train, drives the first variable if. can rack, the antenna, and rf amplifier (0.5- to 2-mc frequency ranges) slug racks, and the second variable if. slug rack (through a cam at the rear of the 1- to 2-mc if slug rack shaft). The KILOCYCLES control also drives the same differential as the MEGACYCLES control to provide movement of the remaining antenna and rf amplifier slug racks. A DIAL ZERO knob on the front panel permits a small correction between the kilocycle reading on the counter and the electrical setting of the tuning system.

38. Functional Analysis of Tuning System
(fig. 30)

a. Figure 30 shows a detailed block diagram of the controlled components in the mechanical tuning system. The frequency-
determining elements change at diffe
rates when the tuning system is opera
For example, to cover the 0.5- to 1-
band, the rf tuning slug rack in Z2
Z207, and Z213 moves from one extre
to the other (approximately 1 inch) w
the first variable if. slug rack (Z219, Z2
and Z221) moves less than one-eighth i
A system of gears under the control
single knob is used to obtain the differ
slug rack travel distances.

b. The block diagram shows the circ
controlled by the MEGACYCLES
KILOCYCLES controls. The KILOCYC
control, operating through a 10-turn st
varies the position of the vfo-mixer tun
the second variable if. slug rack, the fi
variable if. can rack, the 1- to 2-mc s
rack, and the 0.5- to 1-mc slug ra

c. The MEGACYCLES control, op
ating through a 10-turn stop and the Gen
system and overtravel coupler, chan
the position of rf bandswitch S201.
MEGACYCLES control also selects
proper crystals and oscillator output
ing capacitors for the first and sec
crystal oscillators by tuning 32-posi
switch S401 through a group of gears.
32 bands of the receiver are covere
the antenna circuit and the first and sec
rf amplifier circuits with six differ
tuned networks for each circuit. Since e
tuned network has a frequency ratio
two-to-one, six networks (switched
S201) provide a full frequency covera
Synchronization of 6-position switch S
with 32-position switch S401 is acco
plished with the Geneva system.
Geneva system contains a lost-motion g
with a few teeth spaced at intervals aro
its perimeter. A driven gear associa
with the lost-motion gear rotates only w
it is engaged by the teeth on the lost-mot
gear. The MEGACYCLES control, thro
the differential, also affects the poin
which the motion imparted by the KIL
CYCLES control begins. The first varia
if. (9 to 18 mc) slug rack is driven by
MEGACYCLES control. The first varia
if. cans are mounted on a rack which

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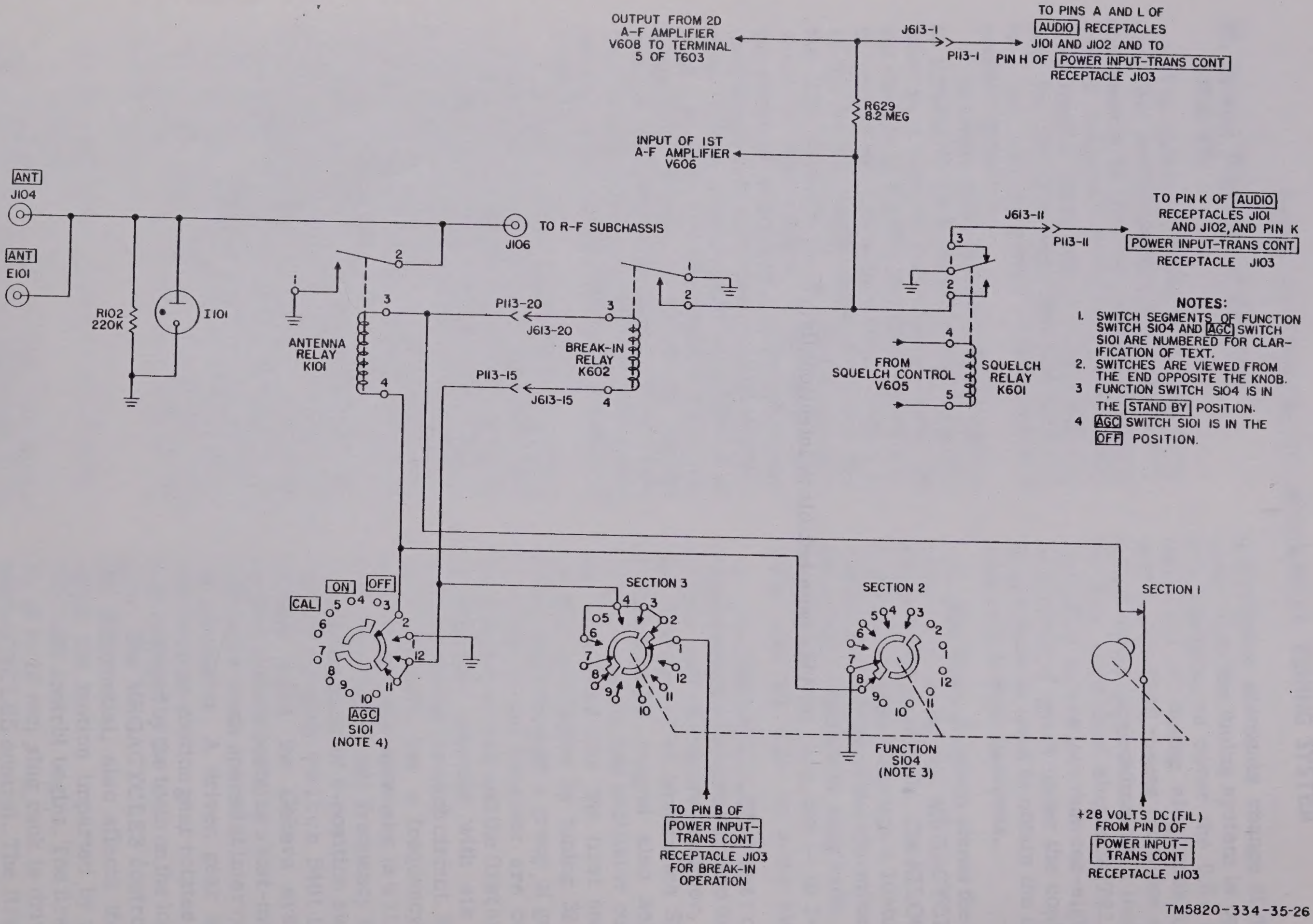

OUTPUT FROM 2D A-F AMPLIFIER V608 TO TERMINAL 5 OF T603
J613-1
P113-1
TO PINS A AND L OF AUDIO RECEPTACLES J101 AND J102 AND TO PIN H OF POWER INPUT-TRANS CONT RECEPTACLE J103
R629 8.2 MEG
INPUT OF 1ST A-F AMPLIFIER V606
ANT J104
ANT E101
TO R-F SUBCHASSIS
J106
R102 220K
I101
ANTENNA RELAY K101
P113-20
J613-20
BREAK-IN RELAY K602
P113-15
J613-15
J613-11
P113-11
TO PIN K OF AUDIO RECEPTACLES J101 AND J102, AND PIN K POWER INPUT-TRANS CONT RECEPTACLE J103
FROM SQUELCH CONTROL V605
SQUELCH RELAY K601
ON
OFF
CAL
AGC
S101 (NOTE 4)
SECTION 3
SECTION 2
SECTION 1
FUNCTION S104 (NOTE 3)
TO PIN B OF POWER INPUT-TRANS CONT RECEPTACLE J103 FOR BREAK-IN OPERATION
+28 VOLTS DC (FIL) FROM PIN D OF POWER INPUT-TRANS CONT RECEPTACLE J103
TM5820-334-35-26

NOTES:

1. SWITCH SEGMENTS OF FUNCTION SWITCH S104 AND AGC SWITCH S101 ARE NUMBERED FOR CLARIFICATION OF TEXT.
2. SWITCHES ARE VIEWED FROM THE END OPPOSITE THE KNOB.
3. FUNCTION SWITCH S104 IS IN THE STAND BY POSITION.
4. AGC SWITCH S101 IS IN THE OFF POSITION.

Figure 27. Control circuits, functional diagram.

4. Function Switch S104
(fig. 26)

a. Function switch S104 performs witching operations which affect the en- re operation of the receiver. Each mode : operation and each stage is affected by ie positions of the sections of this switch. . thorough understanding of the switch inctions is essential to perform success- il troubleshooting and maintenance.

b. The six positions of the function witch are shown in figure 26. To simplify he presentation, only those circuits which re closed by the switch contacts are iden- ified for each position.

(1) *Section 1.* The +28 volts is applied to all filament circuits and antenna break-in relay K101 in all positions except OFF.

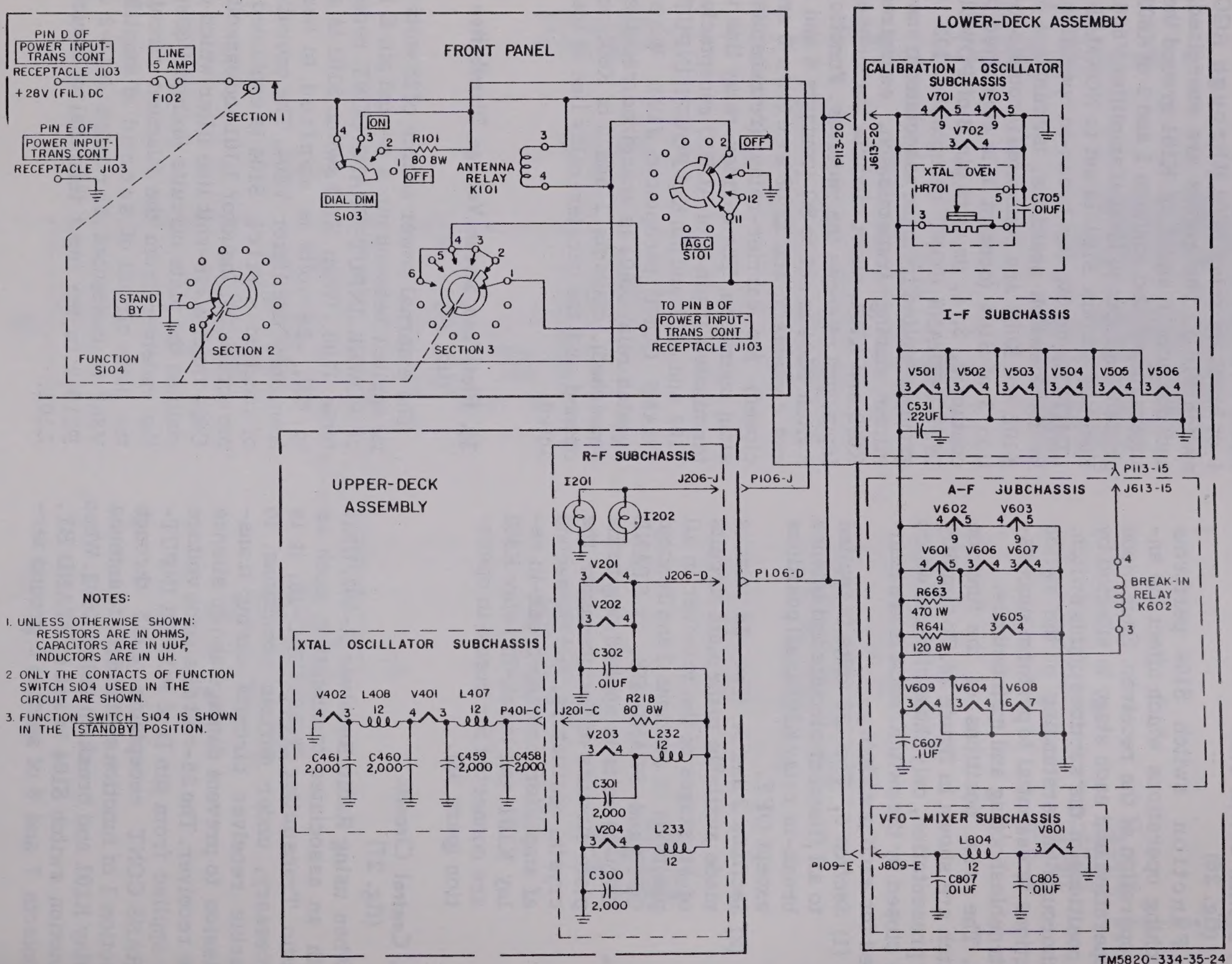
(2) *Sections 2 and 3.* The +28 volts is made available to the plate circuits of all stages of the receiver in all positions of sections 2 and 3 except OFF and STAND BY. At STAND BY, +28 volts is applied only to the plate circuits of the vfo-mixer, the crystal oscillators, and the second af amplifier; antenna break-in relay K101 and break-in relay K602 are connected for break-in operation (para 35).

5. Control Circuits
(fig. 27)

When using Radio Receiver R-392/URR vith an associated transmitter, such as Radio Transmitter T-195/GRC-19, it is ecessary, under certain conditions, to lisable receiver circuits during trans- nission to prevent damage and to silence he receiver. The 28-volt dc source voltage s applied from pin D of POWER INPUT- TRANS CONT receptacle J103 through ection 1 of function switch S104 to antenna elay K101 and break-in relay K602. When unction switch S104 is set to STAND BY, ontacts 7 and 8 of section 2 ground terminal 4 of antenna relay K101 and terminal 4 of break-in relay K602 (through AGC switch S101). The relays are energized, and contacts 1 and 2 of K101 ground the antenna input and contacts 1 and 2 of K602 ground the input to first af amplifier V606. Function switch S104 is set to NORMAL, LIMITER, or SQ for break-in operation. In these switch positions, terminals 4 of K101 and K602 are connected through section 3 of S104 (contact 1 is connected to contact 2, 3, 4, or 6) to pin B of POWER INPUT-TRANS CONT receptacle J103. A ground, applied from the associated transmitter during transmission, energizes K602 and K101, short circuits the antenna input, and silences the receiver. Function switch S104 is set to SQ (contacts 6 and 1 and contacts 7 and 12 of section 3 are closed) for carrier-relay (retransmission) operation. The carrier-relay line is terminated at pin K of AUDIO receptacles J101 and J102 and pin K of POWER INPUT-TRANS CONT receptacle J103. When squelch relay K601 is energized (receiver squelched), contacts 1 and 3 of K601 are opened and the carrier-relay line is disabled.

36. Plate and Screen Voltage Distribution
(fig. 28)

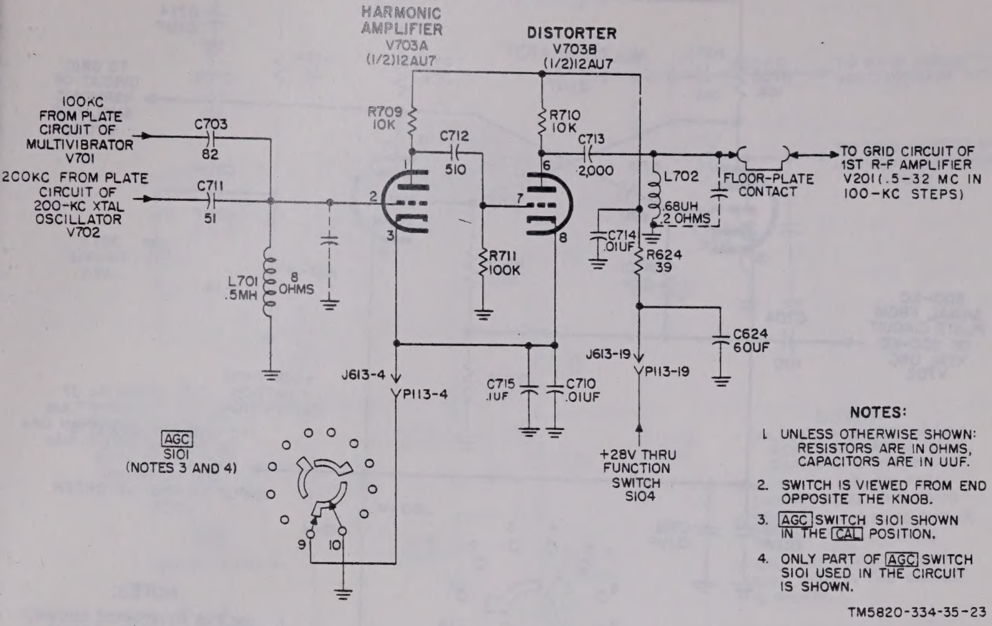
The external power source of 28 volts dc is applied between pin A (+) and pin E (-) of POWER INPUT-TRANS CONT receptacle J103. When BFO switch S102 is set to ON, +28 volts is applied to beat-frequency oscillator V604. The operation of function switch S104 is explained in paragraph 34. Inductor L101 and capacitor C624 form a +28-volt line filter which decouples the plate circuits (except V608) of the receiver from the filament circuits; the plate circuit of second af amplifier V608 is connected through J613-2 and P113-2 to the input terminal of inductor L101.



NOTES:

1. UNLESS OTHERWISE SHOWN: RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF, INDUCTORS ARE IN UH.
2. ONLY THE CONTACTS OF FUNCTION SWITCH S104 USED IN THE CIRCUIT ARE SHOWN.
3. FUNCTION SWITCH S104 IS SHOWN IN THE **STANDBY** POSITION.

TM5820-334-35-24


HARMONIC AMPLIFIER V703A (1/2)12AU7
DISTORTER V703B (1/2)12AU7
100KC FROM PLATE CIRCUIT OF MULTIVIBRATOR V701
200KC FROM PLATE CIRCUIT OF 200-KC XTAL OSCILLATOR V702
C703 82
C711 51
R709 10K
C712 510
R710 10K
C713 2,000
L702
FLOOR-PLATE CONTACT
TO GRID CIRCUIT OF 1ST R-F AMPLIFIER V201 (.5-32 MC IN 100-KC STEPS)
.68UH 2 OHMS
C714 .01UF
R624 39
R711 100K
L701 .5MH
8 OHMS
C624 60UF
J613-19
P113-19
J613-4
P113-4
C715 .1UF
C710 .01UF
AGC
S101 (NOTES 3 AND 4)
+28V THRU FUNCTION SWITCH S104
1
2
3
6
7
8
9
10

NOTES:

1. UNLESS OTHERWISE SHOWN: RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. SWITCH IS VIEWED FROM END OPPOSITE THE KNOB.
3. AGC SWITCH S101 SHOWN IN THE CAL POSITION.
4. ONLY PART OF AGC SWITCH S101 USED IN THE CIRCUIT IS SHOWN.

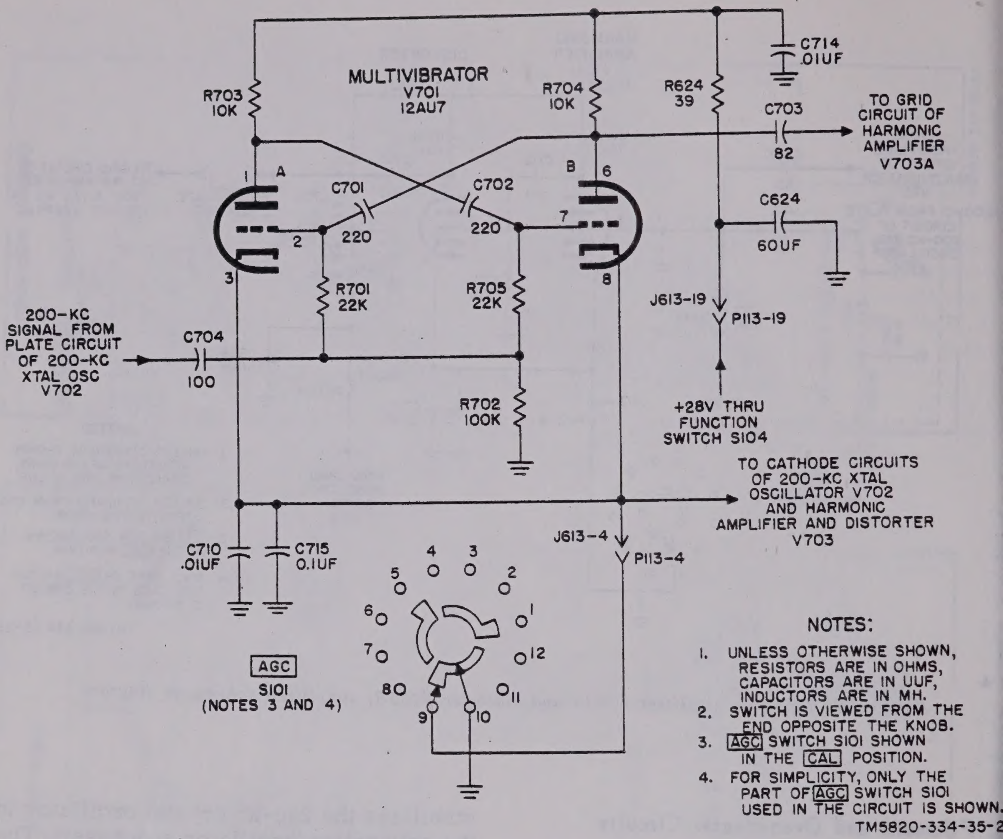
TM5820-334-35-23

Figure 24. Harmonic amplifier V703A and distorter V703B, simplified schematic diagram.

Filament and Oven-Heater Circuits
(fig. 25)

he external power source (28 volts dc)
applied between pins D and E (ground)
POWER INPUT-TRANS CONT recep-
le J103. Nominal filament voltages of
, 12.6, and 25.2 volts are required for
tubes in the receiver. Dial lamps I201,
2, and the filaments which require nom-
l 25.2 volts are parallel-connected with
source voltage. The filaments which
uire 6.3 or 12.6 volts are connected
series circuits. Capacitor-inductor fil-
combinations are used to prevent inter-
ge coupling of high-frequency signals
ough the filament circuits. These filters
C302, L232-C301, L233-C300, C458-
)7-C459, C460-L408-C461, C531, C607,
l C807-L804-C805. Resistor R641 re-
es the voltage across the filament of
)5 to 6.3 volts. Resistor R633 is a fila-
nt shunt for V601. Crystal oven HR701 stabilizes the 200-kc crystal oscillator in the calibration-oscillator subchassis. The oven temperature is controlled by a thermostatic switch. Capacitor C705 is connected across the thermostatic switch contacts to minimize interference caused by switch arcing. LINE 5 AMP fuse F102 protects the external power source from filament and oven-heater circuit shorts. When function switch S104 is set to OFF, filament voltage is disconnected. Filament voltage is connected in all other function switch positions. The dial lamps are fully lighted when DIAL DIM switch S103 is set to ON and are disconnected in the OFF position. At the intermediate switch position, resistor R101 is series-connected with the dial lamps and they light at reduced brilliance. Antenna relay K101 and break-in relay K602 are discussed in paragraph 35.

Note. A transistorized audio module is used in place of V608 in certain receivers.


MULTIVIBRATOR
V701
12AU7
R703
10K
R704
10K
R624
39
C714
.01UF
C703
82
TO GRID CIRCUIT OF HARMONIC AMPLIFIER V703A
A
B
1
6
C701
220
C702
220
C624
60UF
2
7
3
8
R701
22K
R705
22K
200-KC SIGNAL FROM PLATE CIRCUIT OF 200-KC XTAL OSC V702
C704
100
R702
100K
J613-19
P113-19
+28V THRU FUNCTION SWITCH S104
TO CATHODE CIRCUITS OF 200-KC XTAL OSCILLATOR V702 AND HARMONIC AMPLIFIER AND DISTORTER V703
J613-4
P113-4
C710
.01UF
C715
0.1UF
1
2
3
4
5
6
7
8
9
10
11
12
AGC
S101
(NOTES 3 AND 4)
TM5820-334-35-2

NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF, INDUCTORS ARE IN MH.
2. SWITCH IS VIEWED FROM THE END OPPOSITE THE KNOB.
3. AGC SWITCH S101 SHOWN IN THE CAL POSITION.
4. FOR SIMPLICITY, ONLY THE PART OF AGC SWITCH S101 USED IN THE CIRCUIT IS SHOWN.

Figure 23. Multivibrator V701, simplified schematic diagram.

32. Distorter V703B
(fig. 24)

Distorter V703B uses a triode section of a type 12AU7 miniature dual-triode tube. Distorter V703B distorts the output from harmonic amplifier V703A. The operation of distorter V703B is similar to the operation of harmonic amplifier V703A.

a. The cathode of distorter V703B is connected to the V703A cathode. The grid is connected to ground through resistor R711. The +28 volts is applied to the plate through R624 and plate-load resistor R710.

b. The signal from harmonic amplif
V703A is coupled by capacitor C712 to
grid of V703B. Distortion of the input sig
results from grid limiting and plate cu
rent cutoff. The output signal of V703B
developed across plate load resistor R7
and coupled to inductor L702 through ca
citor C713. Inductor L702, shunted
wiring, distributed, and tube capacitanc
increases harmonics in the range of 27
28 mc. The signal is then coupled throu
the floor-plate contact to the grid circ
of first rf amplifier V201. This signal p
vides for calibration at all 100-kc poi
throughout the range of the receiv

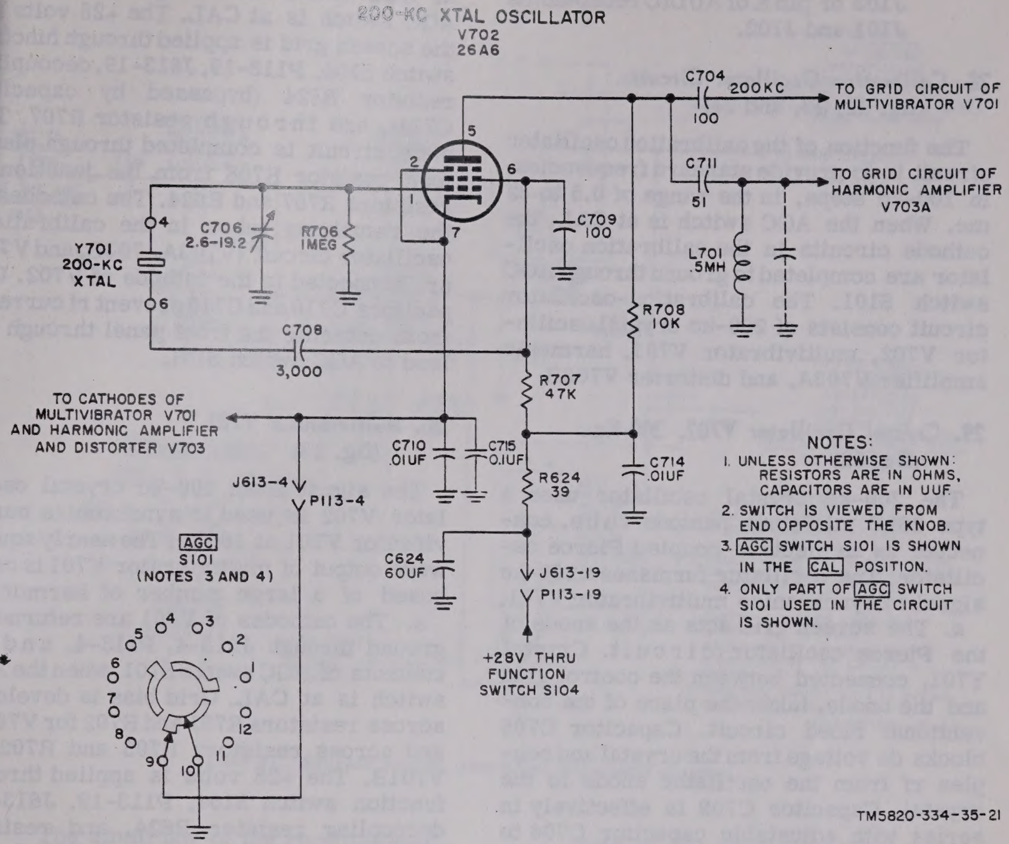

200-KC XTAL OSCILLATOR
V702
26A6
C704
200KC
100
TO GRID CIRCUIT OF MULTIVIBRATOR V701
5
2
6
1
7
C711
51
TO GRID CIRCUIT OF HARMONIC AMPLIFIER V703A
4
Y701
200-KC
XTAL
6
C706
2.6-19.2
R706
1MEG
C709
100
L701
.5MH
R708
10K
C708
3,000
R707
47K
TO CATHODES OF MULTIVIBRATOR V701 AND HARMONIC AMPLIFIER AND DISTORTER V703
C710
.01UF
C715
0.1UF
R624
39
C714
.01UF
J613-4
P113-4
AGC
S101
(NOTES 3 AND 4)
C624
60UF
J613-19
P113-19
+28V THRU FUNCTION SWITCH S104
1
2
3
4
5
6
7
8
9
10
11
12
NOTES:
1. UNLESS OTHERWISE SHOWN: RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. SWITCH IS VIEWED FROM END OPPOSITE THE KNOB.
3. AGC SWITCH S101 IS SHOWN IN THE CAL POSITION.
4. ONLY PART OF AGC SWITCH S101 USED IN THE CIRCUIT IS SHOWN.
TM5820-334-35-21

Figure 22. 200-kc crystal oscillator, simplified schematic diagram.

through capacitor C703 to the grid circuit of harmonic amplifier V703A.

31. Harmonic Amplifier V703A
(fig. 24)

Harmonic amplifier V703A uses a triode section of a type 12AU7 miniature dual-triode tube. Signals from two sources are combined in the V703A grid circuit. The composite signal is amplified and the signal peaks are clipped to increase the harmonic output.

a. The cathode (pin 3) is returned to ground through J613-4, P113-4, and the contacts of AGC switch S101, when the AGC switch is set to CAL. Capacitors C710 and C715 bypass rf voltages to ground. The grid circuit is completed to ground through inductor L701. The +28 volts is applied through function switch S104, P113-19, J613-19, decoupling resistor R624, and plate-load resistor R709 to the plate (pin 1) of V703A.

b. The 100-kc square wave signal from multivibrator V701 is coupled through capacitor C703, and the 200-kc sine wave signal from 200-kc crystal oscillator V702 is coupled through capacitor C711 to the control grid of V703A. These signals combine to form a complex wave which is rich in harmonics. Inductor L701, inductor distributed capacitance, and the input capacitance to V703A tune the grid circuit broadly to approximately 1,000 kc. The amplified signals developed across R709 are coupled through capacitor C712 to the control grid of distorter V703B.

J103 or pin K of AUDIO receptacles J101 and J102.

28. Calibration Oscillator Circuit
(fig. 22, 23, and 24)

The function of the calibration oscillator circuit is to provide standard frequencies, in 100-kc steps, in the range of 0.5 to 32 mc. When the AGC switch is at CAL, the cathode circuits in the calibration oscillator are completed to ground through AGC switch S101. The calibration-oscillator circuit consists of 200-kc crystal oscillator V702, multivibrator V701, harmonic amplifier V703A, and distorter V703B.

29. Crystal Oscillator V702, 200-Kc
(fig. 22)

The 200-kc crystal oscillator uses a type 26A6 miniature pentode tube, connected as an electron-coupled Pierce oscillator. The oscillator furnishes a 200-kc signal to synchronize multivibrator V701.

a. The screen grid acts as the anode of the Pierce oscillator circuit. Crystal Y701, connected between the control grid and the anode, takes the place of the conventional tuned circuit. Capacitor C708 blocks dc voltage from the crystal and couples rf from the oscillator anode to the crystal. Capacitor C709 is effectively in series with adjustable capacitor C706 to provide the proper amount of feedback voltage to the grid to sustain oscillations. Capacitor C706 also permits frequency adjustment of the 200-kc crystal oscillator. Electron coupling to the plate of V702 minimizes instability caused by variations in plate load. Capacitor C711 couples the output of V702 to the grid circuit of harmonic amplifier V703A; the input signal to V703A is developed across a parallel-tuned circuit, consisting of inductor L701 and the inductor distributed capacitance and input capacitance of V703A. The V702 output signal is also coupled by capacitor C704 to the grid circuit of multivibrator V701.

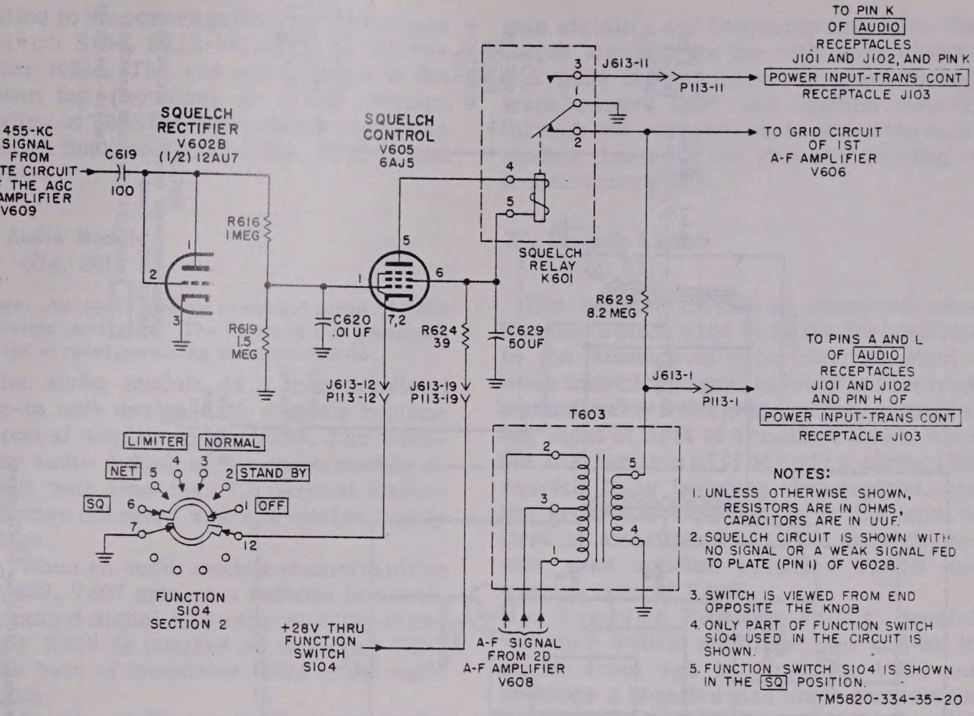
b. Tube V702 is grid-leak biased by the voltage across resistor R706. The suppressor grid and cathode are connected through J613-4, P113-4, and the contacts of AGC switch S101 to ground when th
AGC switch is at CAL. The +28 volts fo
the screen grid is applied through functio
switch S104, P113-19, J613-19, decouplin
resistor R624 (bypassed by capacito
C714), and through resistor R707. Th
plate circuit is completed through plate-load resistor R708 from the junction o
resistors R707 and R624. The cathodes o
the remaining tubes in the calibration
oscillator circuit (V703A, 703B, and V701
are connected to the cathode of V702. Capacitors C710 and C715 prevent rf current
from entering the front panel through th
lead to AGC switch S101.

30. Multivibrator V701
(fig. 23)

The signal from 200-kc crystal oscillator V702 is used to synchronize multivibrator V701 at 100 kc. The nearly squar
wave output of multivibrator V701 is composed of a large number of harmonics

a. The cathodes of V701 are returned t
ground through J613-4, P113-4, and th
contacts of AGC switch S101, when the AG
switch is at CAL. Grid bias is develope
across resistors R701 and R702 for V701A
and across resistors R705 and R702 fo
V701B. The +28 volts is applied throug
function switch S104, P113-19, J613-1
decoupling resistor R624, and resisto
R704, to the plate (pin 6) of V701B, an
through resistor R703 to the plate (pin 1
of V701A. Capacitors C710 and C715 bypass rf voltages to ground (para 29).

b. The signal from 200-kc crystal oscillator V702 is coupled by capacitor C704 t
multivibrator V701. Multivibrator V701 i
a free-running relaxation-type oscillator
which uses a type 12AU7 miniature dual-triode tube. Oscillations are sustained b
feedback from the plate of one tube sectio
to the grid of the other tube section. Th
free-running frequency is determined b
the time constants of the combination of resistors R701, R702, and R705, capacitors
C701 and C702. The 200-kc signal from
200-kc crystal oscillator V702 is developed across resistor R702. This voltag
synchronizes the multivibrator precisel
at 100 kc. The V701 output signal is applie



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. SQUELCH CIRCUIT IS SHOWN WITH NO SIGNAL OR A WEAK SIGNAL FED TO PLATE (PIN 1) OF V602B.
3. SWITCH IS VIEWED FROM END OPPOSITE THE KNOB
4. ONLY PART OF FUNCTION SWITCH S104 USED IN THE CIRCUIT IS SHOWN.
5. FUNCTION SWITCH S104 IS SHOWN IN THE SQ POSITION.

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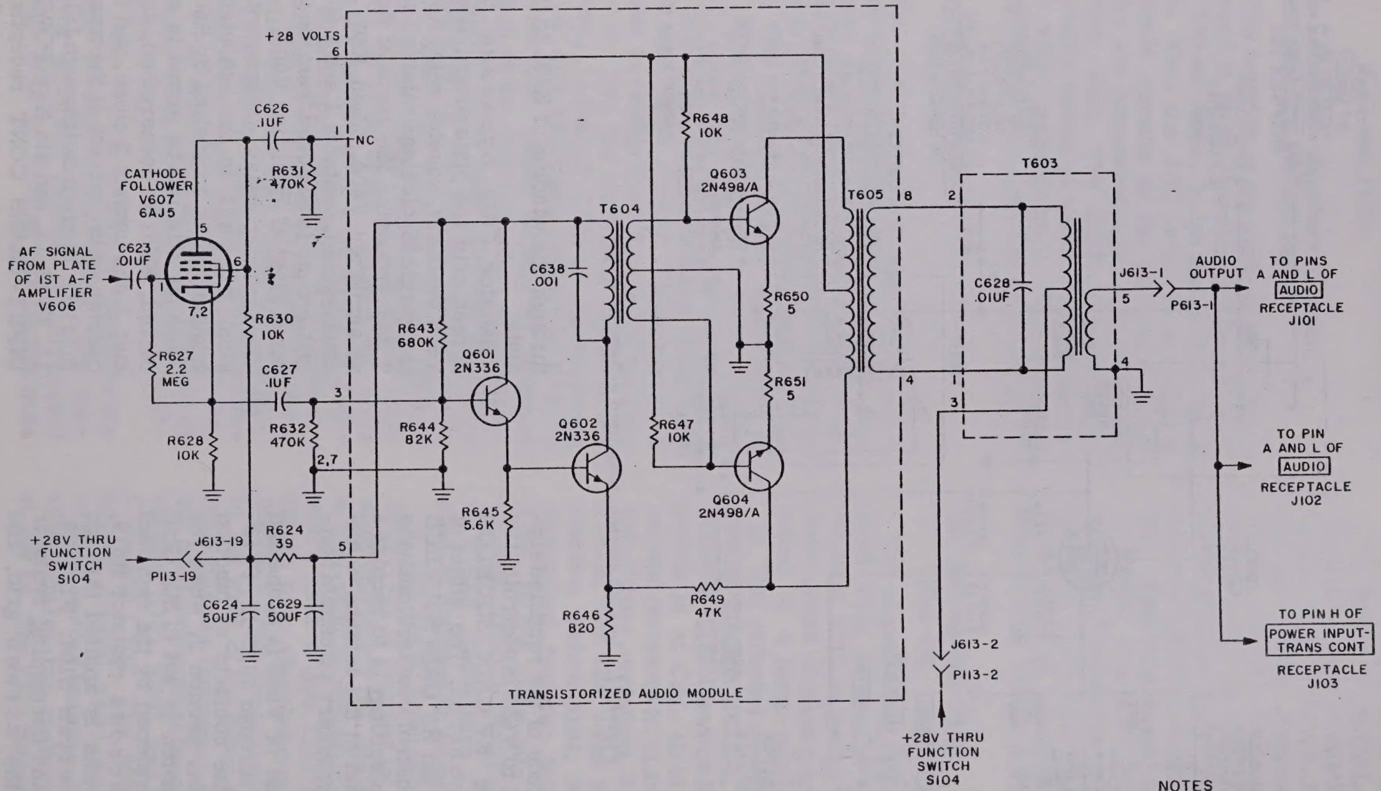
Figure 21. Squelch circuit, simplified schematic diagram.

The amplitude of the rectified signal applied to V605 is controlled by setting the RF GAIN SQUELCH THRESH control. The effect of turning the RF GAIN SQUELCH THRESH control counterclockwise (lower gain setting) is to require a larger signal at the antenna to exceed the necessary threshold voltage.

(2) The cathode of V605 is connected to ground through J613-12, P113-12, and the contacts of function switch S104, section 2, when the function switch is set to SQ. Grid bias is developed by the rectified if. signal across resistor R619. The +28 volts is applied through function switch S104, P113-19, J613-19, and decoupling resistor R624, to the screen grid, and through the winding of K601 to the plate.

(3) Capacitor C629 bypasses the screen grid and plate return. When V605 conducts, squelch relay K601 is energized, closing contacts 1 and 2 and grounding the input of first af amplifier V606. When K601 is deenergized, contacts 1 and 2 open and ground is removed from the input of first af amplifier V606.

(4) The carrier-relay (retransmission) circuit in the associated transmitter is controlled by K601. When an adequate signal is received, K601 is deenergized, contact 1 and contact 3 close, and the carrier-relay circuit of the transmitter is grounded through J613-11, P113-11, and pin K of POWER INPUT-TRANS CONT receptacle



NOTES

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCES ARE IN OHMS
2. ☐ INDICATES EQUIPMENT MARKINGS

TM5820-334-35-80

Figure 20. Audio module, schematic diagram.

pplied to the screen grids through function switch S104, P113-19, J613-19, and resistor R624. The +28 volts is fed to the enter tap (terminal 3) of the primary vinding of T603 for application to the plates hrough function switch S104, P113-2, and 613-2.

6. Audio Module
(fig. 20)

Note. An audio module is used in place of V608 certain receivers. The theory in this paragraph pplies to receivers using an audio module.

The audio module is a transistorized lug-in unit designed to directly replace econd af amplifier tube V608. The maximum audio output of the audio module is watt with less than 7.5 percent distortion when operated with a 28-volt dc supply oltage.

a. When an audio module is used in place f V608, V607 acts as a cathode follower. he output signal taken across cathode resistor R628 is coupled by capacitor C627 the base of transistor Q601 of the audio odule.

b. Emitter follower Q601 matches the npedance between V607 and amplifier 602. The audio input signal is coupled rom the cathode of cathode follower V607, hrough pin 3 of the socket to the base of 601. The +28 volts is applied to the collector of Q601 from pin 5 of the module ocket. Resistors R643 and R644 make up divider which provides the proper base ias for Q601. Resistor R645 is the load esistor for Q601. The output of Q601 is pplied to the base of Q602. The audio output of Q602 is transformer coupled by T604 the bases of the push-pull power output tage which consists of transistors Q603 nd Q604. Capacitor C638 reduces the igher frequency response of T604.

c. The +28 volts is applied from pin 6 of he audio module socket through the primary of T605 to the collectors of Q603 and 604. Resistors R647 and R648 establish he proper base bias. Resistors R650 and 651 are in the emitter circuits to compensate for temperature variations. Resistor R649 provides a negative feedback urrent to Q602 for improved amplifier gain stability and frequency response. The output signal from the collectors of Q603 and Q604 is transformer coupled through transformer T605 and applied directly through pin connections 4 and 8 of the audio module base to the primary winding of transformer T603.

27. Squelch Circuit
(fig. 21)

The squelch circuit is operative when function switch S104 is in the SQ position. In the absence of a carrier, or when a weak incoming signal carrier is received, squelch relay K601 is energized, grounding the input of first af amplifier V606. When the carrier is sufficiently strong, the squelch relay becomes deenergized, and the ground is removed from the input to first af amplifier V606. The squelch circuit uses squelch rectifier V602B and squelch control V605.

a. Squelch Rectifier V602B. Squelch rectifier V602B rectifies the 455-kc if. signal from agc if. amplifier V609 and develops a negative bias which controls the operation of squelch control V605. Squelch rectifier V602B is connected as a diode rectifier. The plate and control grid of V602B are connected together and the cathode is connected to ground. The if. signal from agc if. amplifier V609 is coupled by capacitor C619 to the plate of diode-connected V602B. Resistor R616 and capacitor C620 form a filter which removes rf and audio components from the rectified voltage. The filtered dc voltage developed across resistor R619 is applied to the grid of squelch control V605 as a negative bias voltage.

b. Squelch Control V605. Squelch control V605 activates squelch relay K601 under no signal or low signal conditions (dependent on the setting of RF GAIN SQUELCH THRESH control R105(fig. 9)).

(1) A more negative voltage than the threshold voltage across R619 reduces the plate current of V605 and relay K601 is deenergized. A less negative voltage than the threshold voltage increases the current of V605, and relay K601 is energized.

C626 to the control grid (pin 1) of second af amplifier V608A. An audio signal is also developed across cathode load resistor R628. This signal is equal in amplitude to the plate signal, but 180° out of phase. The cathodes signal is coupled by capacitor C627 to a control grid (pin 3) of second af amplifier V608B.

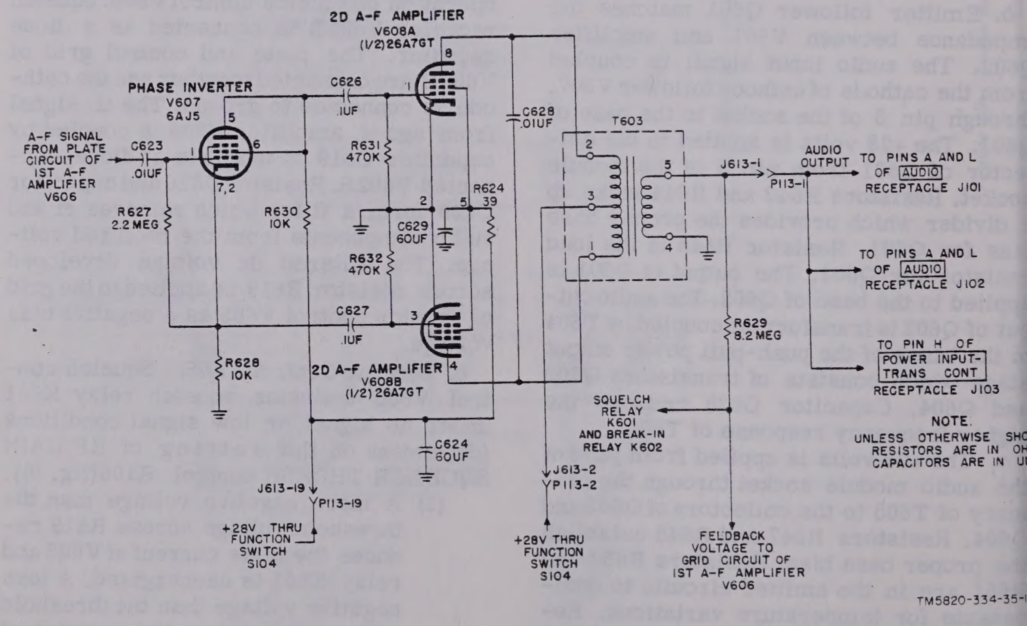
b. Contact bias is developed across resistor R627. The +28 volts is applied through function switch S104, P113-19, J613-19, and plate-load resistor R630 to the screen grid (pin 6) and plate (pin 5). Resistor R627 is connected directly from the cathode to the grid to accommodate negative signals of higher amplitude on the grid without the effects of cutoff limiting. The amplification of the tube is slightly less than one.

25. Second Af Amplifier V608
(fig. 19)

Second af amplifier V608 uses a type 26A7GT dual-pentode tube, connected as a push-pull amplifier. The af power ou put is applied to a 600-ohm headset o loudspeaker.

a. The audio signal from phase invert V607 is coupled to the control grids of V6 through capacitors C626 and C627. T audio voltage developed across R631 is equal amplitude but 180° out of phase w the audio voltage developed across R6 The output from V608 is transformer cc pled to a headset or loudspeaker by tran former T603. The primary of T603 shunted by capacitor C628, which reduc the frequency response of the stage at t higher audiofrequencies. The audio outp from the secondary winding is appli through J613-1 and P113-1 to pins A a L of AUDIO receptacles J101 and J1(and to pin H of POWER INPUT-TRA CONT receptacle J103. Part of the auc signal is used as negative feedback throu resistor R629 to the grid circuit of fi af amplifier V606.

b. Grid bias is developed across r sistors R631 and R632. The +28 volts



2D A-F AMPLIFIER
V608A
(1/2)26A7GT
PHASE INVERTER
V607
6AJ5
A-F SIGNAL FROM PLATE CIRCUIT OF 1ST A-F AMPLIFIER V606
C623
.01UF
C626
.1UF
R631
470K
C628
.01UF
T603
R627
2.2 MEG
R630
10K
R624
39
C629
60UF
R632
470K
C627
.1UF
R628
10K
2D A-F AMPLIFIER
V608B
(1/2) 26A7GT
C624
60UF
J613-19
P113-19
+28V THRU FUNCTION SWITCH S104
AUDIO OUTPUT
J613-1
P113-1
TO PINS A AND L OF AUDIO RECEPTACLE J101
TO PINS A AND L OF AUDIO RECEPTACLE J102
R629
8.2 MEG
TO PIN H OF POWER INPUT-TRANS CONT RECEPTACLE J103
SQUELCH RELAY K601 AND BREAK-IN RELAY K602
J613-2
P113-2
+28V THRU FUNCTION SWITCH S104
FEEDBACK VOLTAGE TO GRID CIRCUIT OF 1ST A-F AMPLIFIER V606
NOTE.
UNLESS OTHERWISE SHO
RESISTORS ARE IN OH
CAPACITORS ARE IN U
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Figure 19. Phase inverter V607 and second audiofrequency amplifier V608, simplified schematic diagra

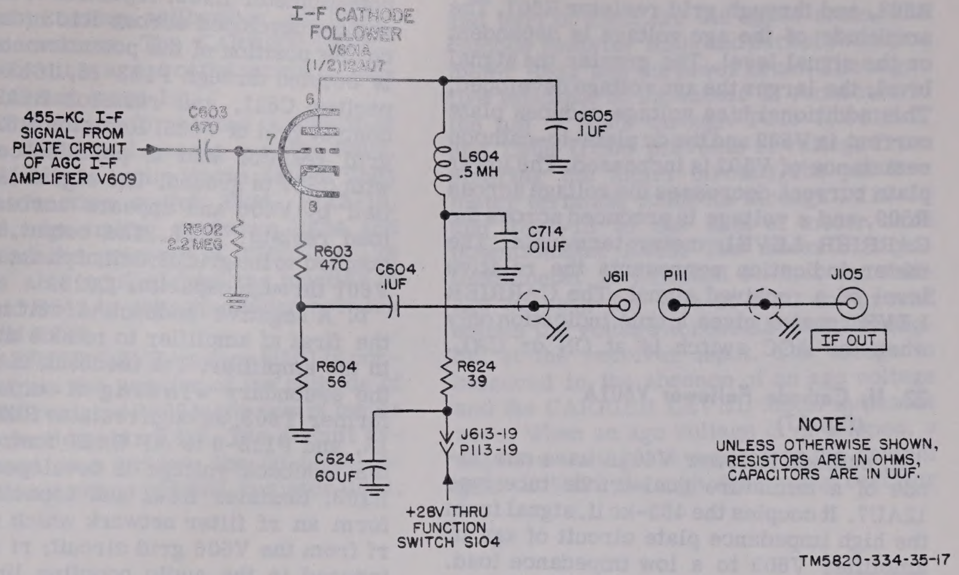

Figure 17. If. cathode follower V601A, simplified schematic diagram.

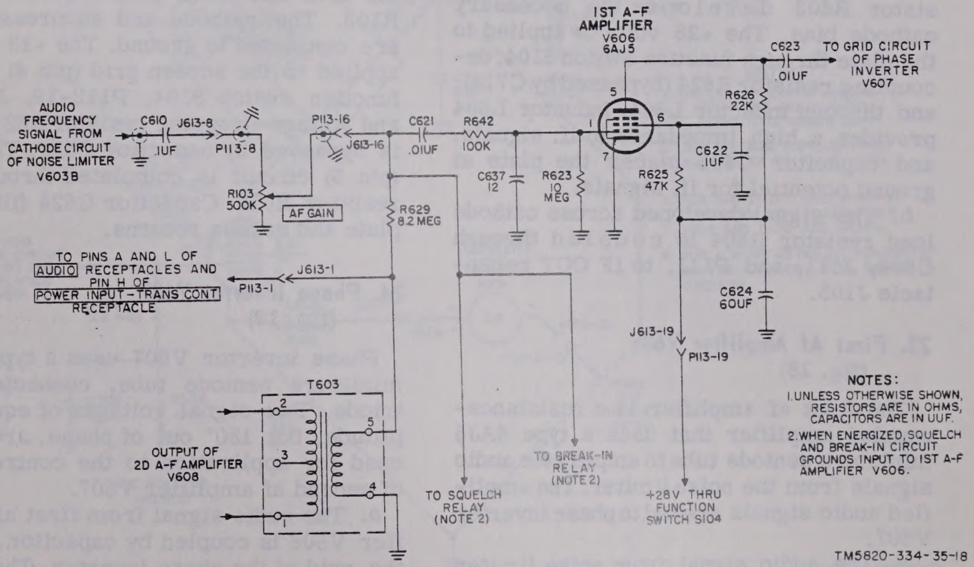
1ST A-F AMPLIFIER
V606
6AJ5
AUDIO FREQUENCY SIGNAL FROM CATHODE CIRCUIT OF NOISE LIMITER V603B
C610
.1UF
J613-8
P113-8
P113-16
J613-16
C621
.01UF
R642
100K
R103
500K
AF GAIN
R629
8.2 MEG
C637
12
R623
10 MEG
5
1
6
7
C623
.01UF
TO GRID CIRCUIT OF PHASE INVERTER V607
R626
22K
C622
.1UF
R625
47K
C624
60UF
J613-19
P113-19
TO PINS A AND L OF AUDIO RECEPTACLES AND PIN H OF POWER INPUT-TRANS CONT RECEPTACLE
J613-1
P113-1
T603
2
3
5
4
1
OUTPUT OF 2D A-F AMPLIFIER V608
TO SQUELCH RELAY (NOTE 2)
TO BREAK-IN RELAY (NOTE 2)
+28V THRU FUNCTION SWITCH S104
NOTES:
1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. WHEN ENERGIZED, SQUELCH AND BREAK-IN CIRCUIT GROUNDS INPUT TO 1ST A-F AMPLIFIER V606.
TM5820-334-35-18

Figure 18. First af amplifier V606, simplified schematic diagram.

R508, and through grid resistor R507. The amplitude of the agc voltage is dependent on the signal level. The greater the signal level, the larger the agc voltage developed. This additional bias voltage reduces plate current in V502 and the dc plate-to-cathode resistance of V502 is increased. The lower plate current decreases the voltage across R509, and a voltage is produced across the CARRIER LEVEL meter terminals. The meter indication represents the relative level of a received signal. The CARRIER LEVEL meter gives a true indication only when the AGC switch is at ON or CAL.

22. If. Cathode Follower V601A
(fig. 17)

If. cathode follower V601A uses one triode of a miniature dual-triode tube type 12AU7. It couples the 455-kc if. signal from the high impedance plate circuit of agc if. amplifier V609 to a low impedance load. This stage is necessary for operating an R-392/URR with a frequency-shift radioteletypewriter converter.

a. The cathode is connected through resistors R603 and R604 to ground. Resistor R604 is the cathode load resistor and resistor R603 develops the necessary cathode bias. The +28 volts is applied to the plate through function switch S104, decoupling resistor R624 (bypassed by C714), and through inductor L604. Inductor L604 provides a high impedance to if. signals, and capacitor C605 places the plate at ground potential for if. signals.

b. The signal developed across cathode load resistor R604 is coupled through C604, J611, and P111, to IF OUT receptacle J105.

23. First Af Amplifier V606
(fig. 18)

The first af amplifier is a resistance-coupled amplifier that uses a type 6AJ5 miniature pentode tube to amplify the audio signals from the noise limiter. The amplified audio signals are fed to phase inverter V607.

a. The audio signal from noise limiter V603B is coupled by capacitor C610 through J613-8 and P113-8 to AF GAIN potentiometer R103. A portion of the sign voltage developed across R103 (dependi on the position of the potentiometer ar is coupled through P113-16, J613-16, c pacitor C621, and resistor R642 to t control grid of V606. Resistor R623 is t grid resistor and is parallel-connect with C637 to ground. The signal is ampl fied by V606 and appears across plat load resistor R626. The output signal coupled to the grid circuit of phase invert V607 through capacitor C623.

b. A negative feedback circuit is used the first af amplifier to reduce distorti in the amplifier. The feedback is fed fro the secondary winding of output trans former T603, through resistor R629, J61 16, and P113-6 to AF GAIN control R10 the feedback voltage is developed acro R103. Resistor R642 and capacitor C6 form an rf filter network which remov rf from the V606 grid circuit; rf might induced in the audio coupling lines by nearby transmitter.

c. Contact bias is developed acro R623. Capacitor C621 prevents the bi from being shunted through the low resistance of resistor R642 in series wi the arm and lower part of potentiomet R103. The cathode and suppressor gr are connected to ground. The +28 volts applied to the screen grid (pin 6) throu function switch S104, P113-19, J613-1 and voltage-dropping resistor R625, whi is bypassed by capacitor C622. The pla (pin 5) circuit is completed through lo resistor R626. Capacitor C624 filters t plate and screen returns.

24. Phase Inverter V607
(fig. 19)

Phase inverter V607 uses a type 6AJ miniature pentode tube, connected as triode. Two signal voltages of equal an plitude, but 180° out of phase, are deve oped for application to the control gri of second af amplifier V607.

a. The audio signal from first af ampl fier V606 is coupled by capacitor C623 the grid of the phase inverter. The sign at the plate is developed across plate-lo resistor R630 and is coupled by capacit

an aid in tuning, calibration, and align-
nt procedures. The CARRIER LEVEL
ter circuit is a part of the second if. am-
fier circuit (para 14).

a. Cathode bias for second if. amplifier
02 is developed across resistor R509.
e +28 volts is applied to the plate of V502
ough function switch S104, P113-19,
13-19, decoupling resistors R624 and
12, and the primary of T502. The +28
ts is also applied from the junction of
24 and R512 to voltage-divider network
21 and R622.

b. CARRIER LEVEL meter M101 is con-
cted from the junction of the cathode of
02 and resistor R509 to the arm of meter
ro potentiometer R622. The circuit ar-
ngement is a bridge; the dc plate-to-
thode resistance of V502, resistor R621,
and part of R622 are the upper arms, and cathode resistor R509 and part of potentiometer R622 are the lower arms. The negative terminal of the meter is connected to the top of R509 through P113-7, J613-7, and L506 (L506 prevents rf voltage from entering the meter circuit). The positive meter terminal connects through P113-10 and J613-10 to the arm of meter zero potentiometer R622. The meter zero potentiometer is adjusted so that the voltage between the arm of R622 and ground equals the voltage across R509 with no signal at the receiver input. The bridge is balanced in the absence of an agc voltage and the CARRIER LEVEL meter indicates zero. When an agc voltage is developed, a negative voltage is applied to the control grid of V502 through decoupling resistor

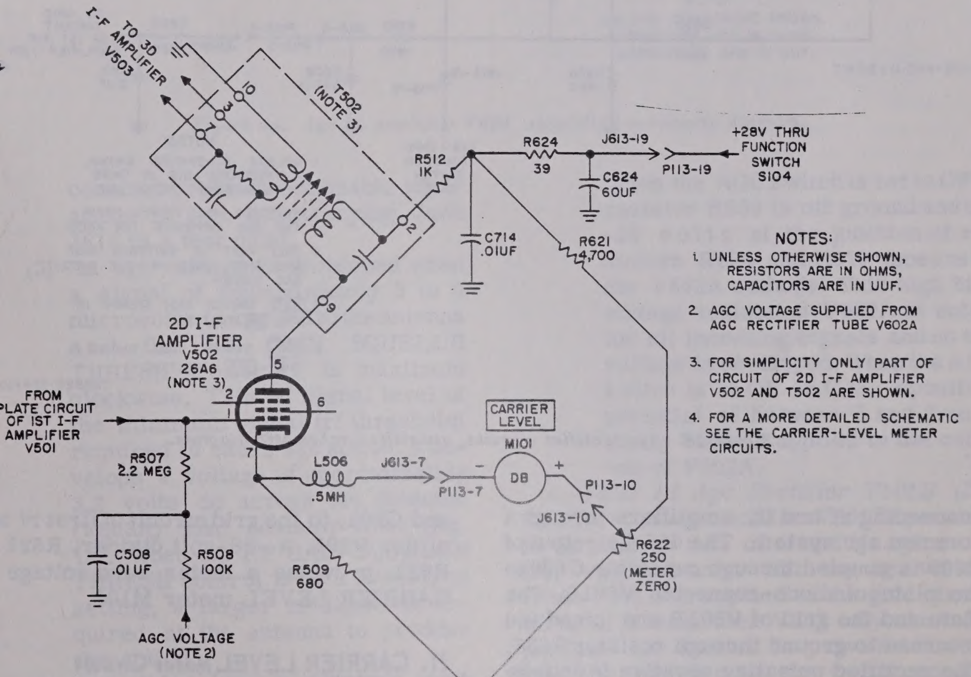
TO 3D I-F AMPLIFIER V503
T502 (NOTE 3)
10
3
7
2
9
R512 1K
R624 39
J613-19
P113-19
+28V THRU FUNCTION SWITCH S104
C624 60UF
C714 .01UF
R621 4,700
NOTES:
1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. AGC VOLTAGE SUPPLIED FROM AGC RECTIFIER TUBE V602A
3. FOR SIMPLICITY ONLY PART OF CIRCUIT OF 2D I-F AMPLIFIER V502 AND T502 ARE SHOWN.
4. FOR A MORE DETAILED SCHEMATIC SEE THE CARRIER-LEVEL METER CIRCUITS.
2D I-F AMPLIFIER V502 26A6 (NOTE 3)
5
2
1
6
7
FROM PLATE CIRCUIT OF 1ST I-F AMPLIFIER V501
R507 2.2 MEG
L506 .5MH
J613-7
P113-7
CARRIER LEVEL
M101
DB
-
+
P113-10
J613-10
R622 250 (METER ZERO)
C508 .01 UF
R508 100K
R509 680
AGC VOLTAGE (NOTE 2)

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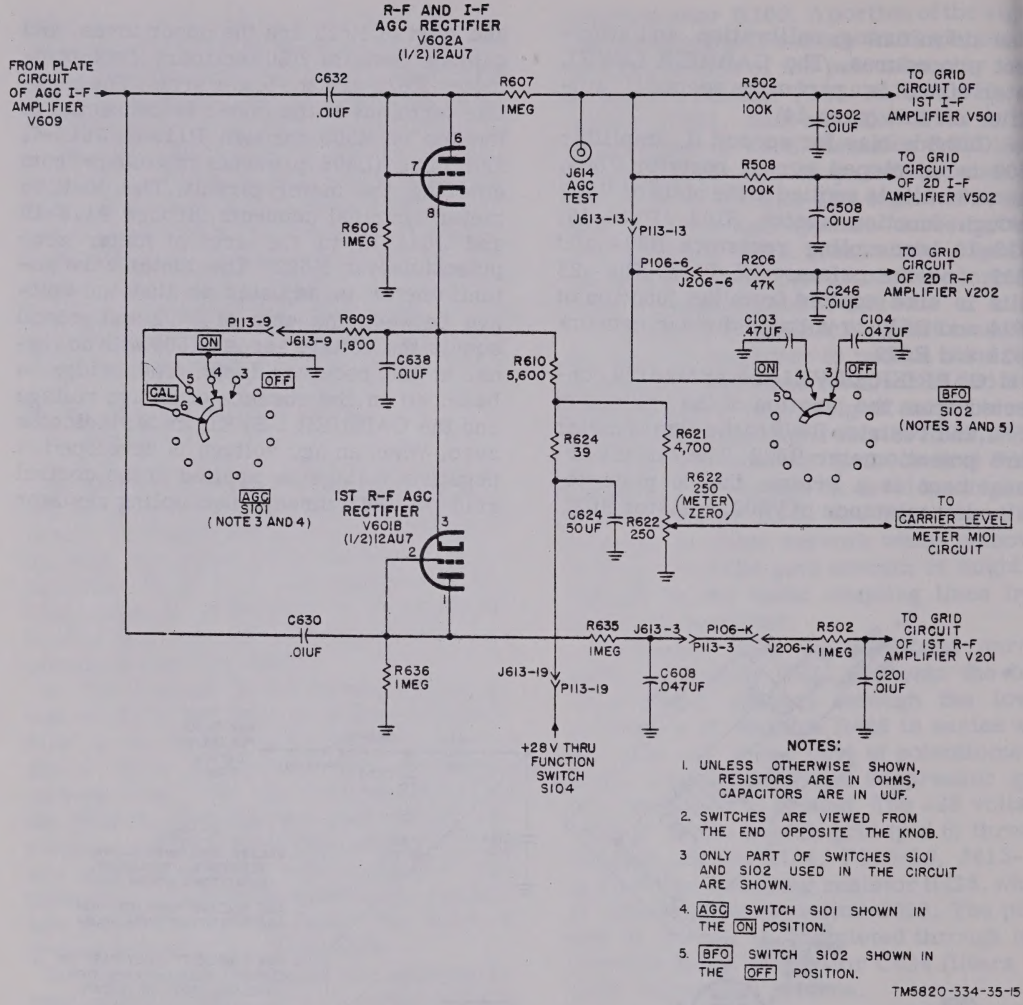
Figure 16. CARRIER LEVEL meter circuit, simplified schematic diagram.



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. SWITCHES ARE VIEWED FROM THE END OPPOSITE THE KNOB.
3. ONLY PART OF SWITCHES S101 AND S102 USED IN THE CIRCUIT ARE SHOWN.
4. AGC SWITCH S101 SHOWN IN THE ON POSITION.
5. BFO SWITCH S102 SHOWN IN THE OFF POSITION.

Figure 15. Agc rectifier circuits, simplified schematic diagram.

succeeding rf and if. amplifiers through a common agc system. The 455-kc output of V609 is coupled through capacitor C630 to the plate of diode-connected V601B. The plate and the grid of V601B are joined and returned to ground through resistor R636. The rectified pulsating negative dc voltage developed across R636 is filtered by resistor R635 and capacitor C608. The agc voltage is applied through J613-3, P113-3, P106-K, J206-K, and filter network R502 and C201, to the grid circuit of first rf amplifier V201. A +28-volt divider, R621 an R622, provides a meter zero voltage fo CARRIER LEVEL meter M101.

21. CARRIER LEVEL Meter Circuit
(fig. 16)

CARRIER LEVEL meter M101 indicate the relative signal strength in decibels (db above the agc threshold (delay) voltage. I

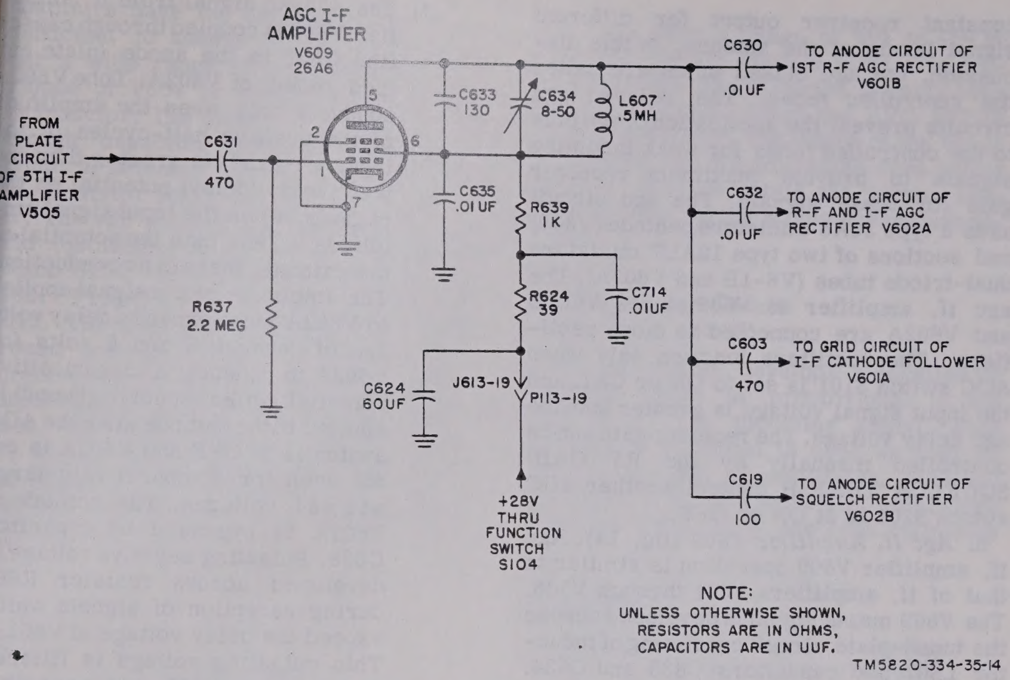

AGC I-F AMPLIFIER
V609
26A6
FROM PLATE CIRCUIT OF 5TH I-F AMPLIFIER V505
C631
470
5
2
6
1
7
R637
2.2 MEG
C633
130
C634
8-50
L607
.5MH
C635
.01 UF
R639
1K
R624
39
C714
.01UF
C624
60UF
J613-19
P113-19
+28V THRU FUNCTION SWITCH S104
C630
.01UF
TO ANODE CIRCUIT OF IST R-F AGC RECTIFIER V601B
C632
.01UF
TO ANODE CIRCUIT OF R-F AND I-F AGC RECTIFIER V602A
C603
470
TO GRID CIRCUIT OF I-F CATHODE FOLLOWER V601A
C619
100
TO ANODE CIRCUIT OF SQUELCH RECTIFIER V602B
NOTE:
UNLESS OTHERWISE SHOWN,
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.
TM5820-334-35-14

Figure 14. Agc if. amplifier V609, simplified schematic diagram.

constant prevents noticeable variations in gain due to keying. Jack J614 is a test point.

(3) An agc voltage is developed when a signal of approximately 3 to 5 microvolts is applied to the antenna and the RF GAIN SQUELCH THRESH control is maximum clockwise. This rf signal level is the minimum signal (rf threshold) required to cause agc action. It develops a voltage of approximately 3.2 volts dc across the detector (V603A) load resistor R605 (fig. 12). When the RF GAIN SQUELCH THRESH control is at a lower gain setting, a larger rf signal is required at the antenna to produce agc action.

(4) Agc delay bias is obtained from +28-volt voltage divider R610 and R609; the voltage across R609 is applied to the cathode of V602A. When the AGC switch is set to OFF, resistor R609 is off ground and the +28 volts at the junction of resistors R624 and R610 appears at the V602A cathode. This high bias voltage maintains V602A at cutoff for all incoming signals and no agc voltage is developed. When the AGC switch is at ON or CAL, a positive potential of between 5 and 6 volts (delay bias) is applied to the cathode of V602A.

c. *First Rf Agc Rectifier V601B* (fig. 15). First rf agc rectifier V601B operation is similar to that of rf and if. agc rectifier V602A except that the agc voltage from V601B is applied to the grid circuit of first rf amplifier V201 only. An independent agc system is provided for the first rf amplifier to prevent receiver blocking. Large off-tune rf voltages applied to the first rf amplifier might cause grid current flow and affect the biasing of constant receiver output for different signal levels at the antenna. In this discussion, the agc biased tubes are called the *controlled tubes*. The delayed agc circuits prevent the application of agc bias to the *controlled tubes* for weak incoming signals to provide maximum receiver gain for these signals. The agc circuit uses a type 26A6 miniature pentode (V609) and sections of two type 12AU7 miniature dual-triode tubes (V6-1B and V602A). The agc if. amplifier is V609; tubes V601B and V602A are connected as diode rectifiers. The rectifiers function only when AGC switch S101 is set to ON or CAL and the input signal voltage is greater than the agc delay voltage. The receiver gain can be controlled manually by the RF GAIN SQUELCH THRESH control whether AGC switch S101 is at ON or OFF.

a. Agc If. Amplifier V609 (fig. 14). Agc if. amplifier V609 operation is similar to that of if. amplifiers V501 through V506. The V609 output signal is developed across the tuned-plate circuit consisting of inductor L607 and capacitors C633 and C634. Trimmer capacitor C634 is for circuit alignment. Plate and screen-grid voltage is applied to V609 from switch S104 through P113-19 and J613-19 and through decoupling resistors R624 and R639. Capacitor C714 is an rf filter capacitor for the +28-volt line, and capacitor C635 is screen-grid and plate return bypass capacitor. The agc if. amplifier is grid-leak biased by the network consisting of capacitor C631 and resistor R637. The output of V609 is fed to four circuits: first rf agc rectifier V601B through capacitor C630; rf and if. agc rectifier V602A through capacitor C632; if. cathode follower C601A through capacitor C603; and squelch rectifier V602B through capacitor C619.

b. Rf and If. Agc Rectifier V602A (fig. 15). Rf and if. agc rectifier V602A is connected as a diode rectifier. The stage produces a negative dc potential, which is applied to the control grids of the second rf amplifier and the first and second if. amplifiers to control their gain. The receiver output level is held nearly constant, regardless of incoming signal strength variations.

(1) The 455-kc signal from if. amplifier V609 is coupled through capacitor C632 to the anode (plate an grid joined) of V602A. Tube V602 conducts only when the amplitud of the positive half-cycles of th input signal is greater than th positive dc (delay) potential on th cathode. When the input signal amplitude is less than the potential o the cathode, there is no conduction The amplitude of the signal applie to V602A must exceed a delay voltage of between 5 and 6 volts fo V602A to conduct. A large positiv potential (with respect to ground) i applied to the cathode when the AG switch is at OFF and V602A is cu off even for comparatively larg signal voltages. The cathode c V602A is bypassed by capacito C638. Pulsating negative voltage i developed across resistor R60 during reception of signals whic exceed the delay voltage at V602A This pulsating voltage is filtere by resistor R607 and capacito C103 and C104 (dependent on position of BFO switch S102). The ag voltage is also filtered by resisto R502 and capacitor C502 and applied to the grid circuit of first if amplifier V501. The agc voltage i also applied to the grid circuit o second if. amplifier V502 throug filter network R508 and C508, anc to the grid circuit of second rf amplifier V202 through J613-13 P113-13, P106-6, J206-6, and filter network R206 and C245.

(2) Capacitor C103 or C104 is connected into the circuit by a sectio of BFO switch S102 to control th time constant of the agc circuit When BFO switch S102 is at OFF capacitor C104 is connected int the circuit to provide the time constant required for voice reception When S102 is at ON, C104 is disconnected, and C103 is connecte to provide a longer time constan for cw reception. The longer time

pacitors have the correct temperature
oefficient to assure frequency stability
ver a wide range of temperatures. The
thode of V604 is connected to a tap on
e inductor. The output of V604 is coupled
rough capacitor C618 to the cathode
rcuit of detector V603A.

b. Resistor R613 is the grid-leak resis-
r. The +28 volts is applied to the screen
rid (oscillator anode) through function
vitch S104, the contacts of BFO switch
.02, P113-18, J613-18, and resistor
515. The suppressor grid (pin 2) is at
round potential. Capacitor C617 is the
creen-grid bypass capacitor. The bfo
tput signal is developed across inductor
606. When the BFO switch is at OFF,
28 volts is disconnected from the plate
nd screen of the oscillator.

c. The frequency of the bfo signal can be varied over a range of 451 to 459 kc with BFO PITCH control C101. The frequency of the bfo is varied linearly over its entire range. When the BFO PITCH control is set to 0, the output of the bfo is exactly 455 kc. An adjustable core within L605 is used to obtain the proper frequency range during alignment and adjustment.

20. Delayed Agc Circuits
(fig. 14 and 15)

The agc circuit develops a negative dc potential which is proportional to the strength of the incoming signal. This negative dc potential is used as bias on first and second rf amplifiers, V201 and V202, and first and second if. amplifiers V501 and V502. This agc bias maintains

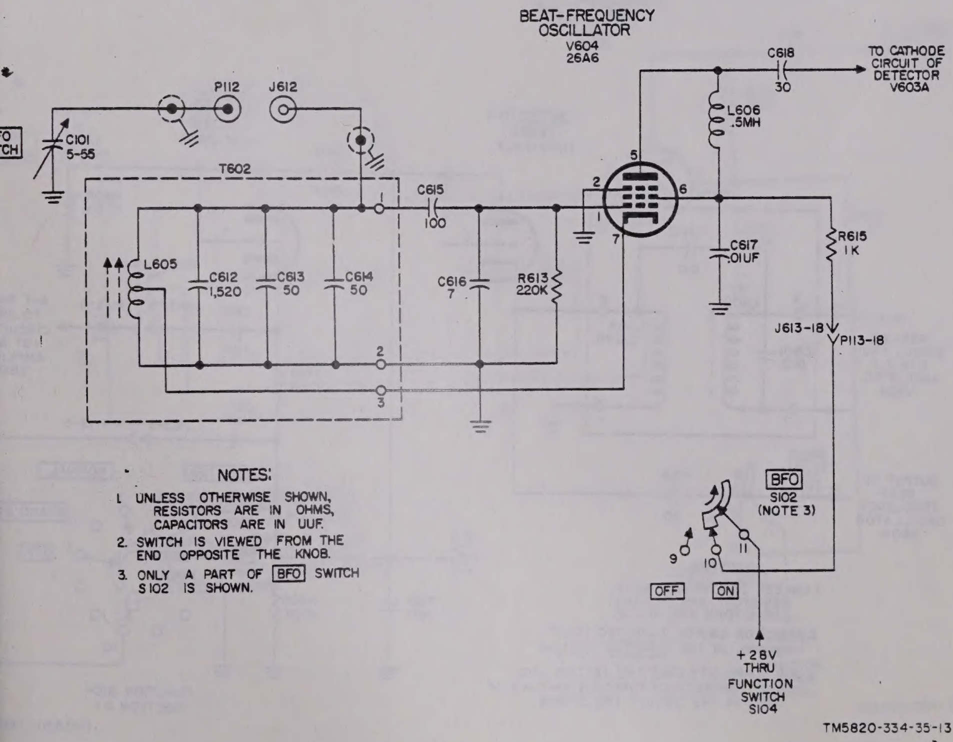

BEAT-FREQUENCY OSCILLATOR
V604
26A6
C618
30
TO CATHODE CIRCUIT OF DETECTOR V603A
P112
J612
O
CH
C101
5-55
L606
.5MH
T602
5
2
6
C615
100
1
7
R615
1K
L605
C612
1,520
C613
50
C614
50
C616
7
R613
220K
C617
.01UF
J613-18
P113-18
2
3
NOTES:
1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. SWITCH IS VIEWED FROM THE END OPPOSITE THE KNOB.
3. ONLY A PART OF BFO SWITCH S102 IS SHOWN.
BFO
S102
(NOTE 3)
9
10
11
OFF
ON
+28V THRU FUNCTION SWITCH S104
TM5820-334-35-13

Figure 13. Beat-frequency oscillator, simplified schematic diagram.

through J613-5, P113-5, and contacts 10 and 7 of S104. Capacitor C611 is charged through resistor R611 to the negative average dc voltage across R605; this voltage is applied to the cathode of V603B. Since the time constant of the network is long compared with the duration of the noise signal peaks, a noise peak causes no appreciable change in the voltage across capacitor C611. The negative noise peaks are coupled to V603B (as part of the audio component) through capacitor C609 and drive the plate more negative than the cathode (since the cathode does not change appreciably for the noise peak duration) and the tube is cut off. This action effectively removes the coupling to first af amplifier V606 for the duration of each noise peak.

19. Beat-Frequency Oscillator V604
(fig. 13)

A beat-frequency oscillator facilitate accurate tuning and permits the receptio of radiotelegraph (cw) signals. When BF switch S102 is at ON, beat frequenc oscillator V604 generates a signal which i mixed with the 455-kc if. signal detecto V603A. The mixing action produces a audible beat note in the output of th receiver. The bfo uses a type 26A miniature pentode tube connected as a electron-coupled Hartley oscillator.

a. The screen grid of V604 acts as th anode for the oscillator. The contr grid is coupled through grid-leak ca pacitor C615 to the tuned circuit in T60 which consists of inductor L605 and par allel-connected capacitors C612, C61 and C614; capacitor C616 provides addi tional capacitance external to T602. Th

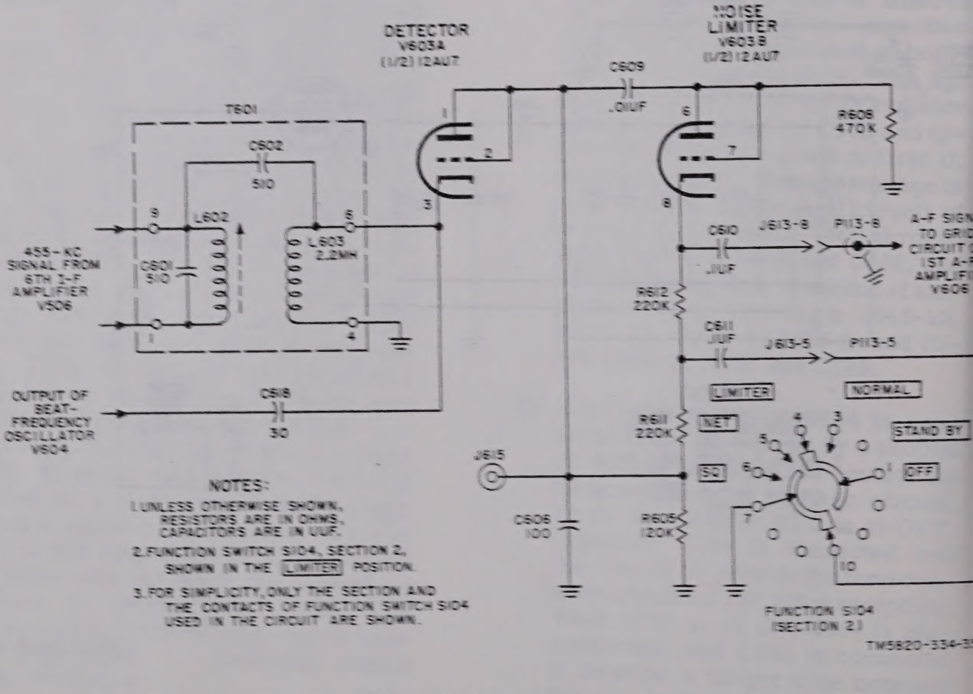

DETECTOR
V603A
(1/2) 12AU7
NOISE
LIMITER
V603B
(1/2) 12AU7
C609
.01UF
T601
C602
510
R606
470K
455-KC SIGNAL FROM 6TH I-F AMPLIFIER V506
L602
L603
2.2MH
C601
510
C610
J613-8
P113-8
A-F SIGN TO GRID CIRCUIT 1ST A-F AMPLIFI V606
R612
220K
C611
.1UF
J613-5
P113-5
OUTPUT OF BEAT-FREQUENCY OSCILLATOR V604
C618
30
LIMITER
NORMAL
R611
220K
NET
STAND BY
J615
SQ
OFF
C606
100
R605
120K
NOTES:
1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. FUNCTION SWITCH S104, SECTION 2, SHOWN IN THE LIMITER POSITION.
3. FOR SIMPLICITY, ONLY THE SECTION AND THE CONTACTS OF FUNCTION SWITCH S104 USED IN THE CIRCUIT ARE SHOWN.
FUNCTION S104 (SECTION 2)
TM5820-334-3

Figure 12. Detector and noise limiter, simplified schematic diagram.

apacitors have the correct temperature oefficient to assure frequency stability ver a wide range of temperatures. The athode of V604 is connected to a tap on he inductor. The output of V604 is coupled hrough capacitor C618 to the cathode ircuit of detector V603A.

b. Resistor R613 is the grid-leak resistor. The +28 volts is applied to the screen grid (oscillator anode) through function switch S104, the contacts of BFO switch S102, P113-18, J613-18, and resistor R615. The suppressor grid (pin 2) is at ground potential. Capacitor C617 is the screen-grid bypass capacitor. The bfo output signal is developed across inductor L606. When the BFO switch is at OFF, +28 volts is disconnected from the plate and screen of the oscillator.

c. The frequency of the bfo signal can be varied over a range of 451 to 459 kc with BFO PITCH control C101. The frequency of the bfo is varied linearly over its entire range. When the BFO PITCH control is set to 0, the output of the bfo is exactly 455 kc. An adjustable core within L605 is used to obtain the proper frequency range during alignment and adjustment.

20. Delayed Agc Circuits
(fig. 14 and 15)

The agc circuit develops a negative dc potential which is proportional to the strength of the incoming signal. This negative dc potential is used as bias on first and second rf amplifiers, V201 and V202, and first and second if. amplifiers V501 and V502. This agc bias maintains

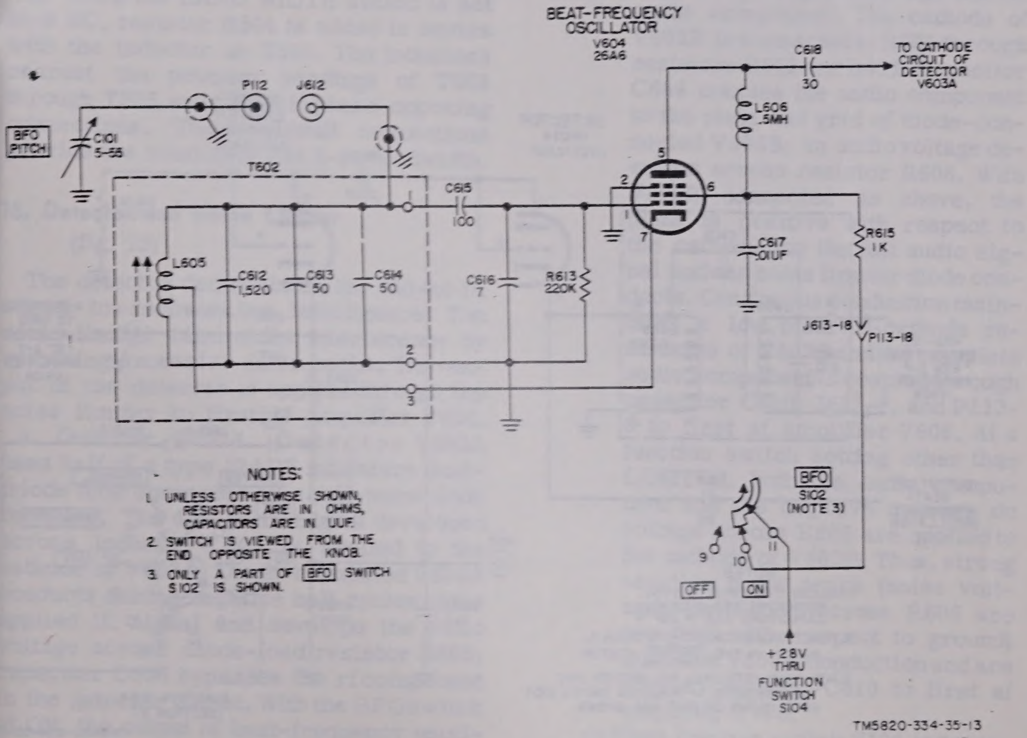

BEAT-FREQUENCY OSCILLATOR
V604
26A6
C618
30
TO CATHODE CIRCUIT OF DETECTOR V603A
L606
.5MH
5
2
6
1
7
C617
.01UF
R615
1K
J613-18
P113-18
P112
J612
BFO PITCH
C101
5-55
T602
C615
100
L605
C612
1,520
C613
50
C614
50
C616
7
R613
220K
2
3
BFO
S102
(NOTE 3)
9
10
11
OFF
ON
+28V
THRU
FUNCTION
SWITCH
S104
NOTES:
1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. SWITCH IS VIEWED FROM THE END OPPOSITE THE KNOB.
3. ONLY A PART OF BFO SWITCH S102 IS SHOWN.
TM5820-334-35-13

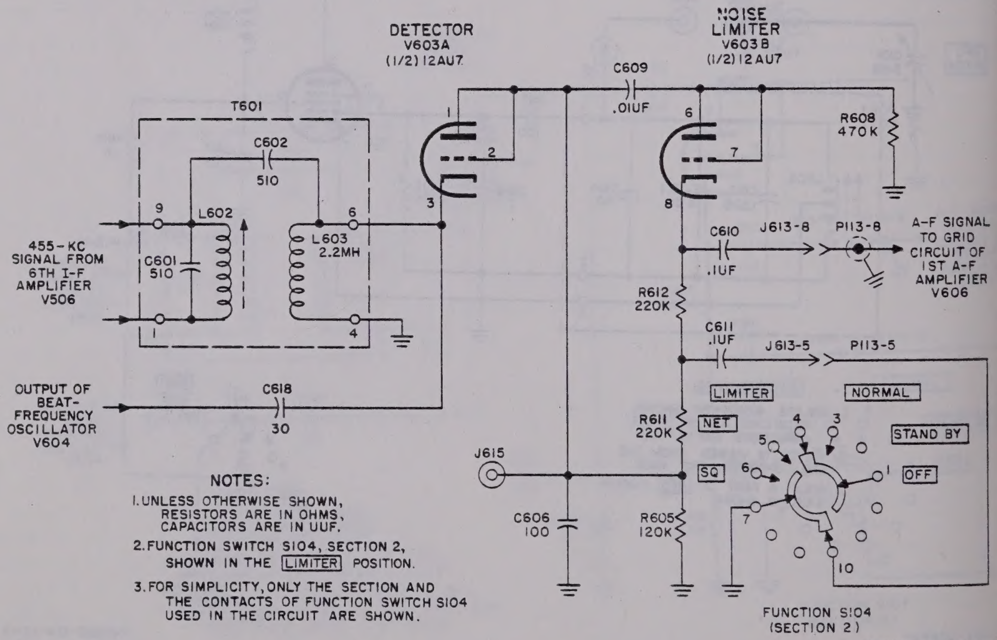
Figure 13. Beat-frequency oscillator, simplified schematic diagram.

through J613-5, P113-5, and contacts 10 and 7 of S104. Capacitor C611 is charged through resistor R611 to the negative average dc voltage across R605; this voltage is applied to the cathode of V603B. Since the time constant of the network is long compared with the duration of the noise signal peaks, a noise peak causes no appreciable change in the voltage across capacitor C611. The negative noise peaks are coupled to V603B (as part of the audio component) through capacitor C609 and drive the plate more negative than the cathode (since the cathode does not change appreciably for the noise peak duration) and the tube is cut off. This action effectively removes the coupling to first af amplifier V606 for the duration of each noise peak.

19. Beat-Frequency Oscillator V604
(fig. 13)

A beat-frequency oscillator facilitates accurate tuning and permits the reception of radiotelegraph (cw) signals. When BFO switch S102 is at ON, beat frequency oscillator V604 generates a signal which is mixed with the 455-kc if. signal detector V603A. The mixing action produces an audible beat note in the output of the receiver. The bfo uses a type 26A6 miniature pentode tube connected as an electron-coupled Hartley oscillator.

a. The screen grid of V604 acts as the anode for the oscillator. The control grid is coupled through grid-leak capacitor C615 to the tuned circuit in T602, which consists of inductor L605 and parallel-connected capacitors C612, C613, and C614; capacitor C616 provides additional capacitance external to T602. The



NOTES:
1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. FUNCTION SWITCH S104, SECTION 2, SHOWN IN THE LIMITER POSITION.
3. FOR SIMPLICITY, ONLY THE SECTION AND THE CONTACTS OF FUNCTION SWITCH S104 USED IN THE CIRCUIT ARE SHOWN.

Figure 12. Detector and noise limiter, simplified schematic diagram.

each transformer to produce a given gree of mutual coupling.

· When the BAND WIDTH switch is set 2 KC, a single coupling inductor of nsformer T501 (fig. 9) and the middle luctors in transformers T502, T503, 04, and T505 are connected in series th the transformer secondaries. These ddle inductors are in a phase-opposing nnection and provide the sharpest se- ctivity, because the smallest degree of tual coupling exists between the primary d secondary windings.

. When the BAND WIDTH switch is set 4 KC, mutual coupling in transformer 01 is unchanged. The inductors farthest om the primary windings of T502, T503, 04, and T505 are placed in phase-aiding nnections. The mutual coupling between primary and secondary windings is in- eased and the bandwidth is broadened.

. When the BAND WIDTH switch is set 8 KC, resistor R504 is added in series th the inductor in T501. The inductors arest the primary windings of T502 ough T505 are placed in phase-opposing nnections. These circuit connections ovide the relatively flat 8-kc bandwidth.

Detector and Noise Limiter
(fig. 12)

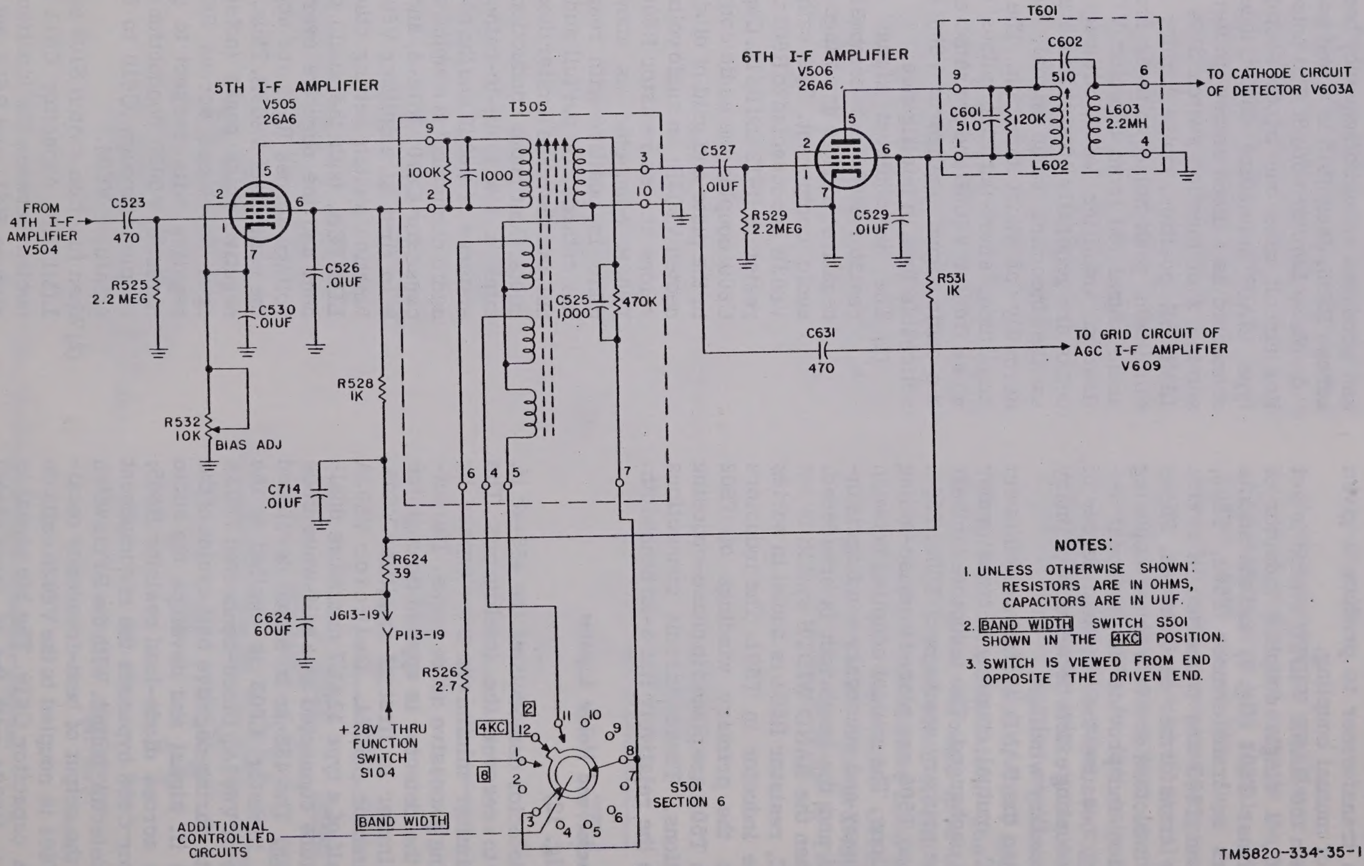
The detector demodulates the 455-kc if. gnal to recover the intelligence. The ise limiter minimizes interference by moving excessive noise peaks. The out- t of the detector is applied through the ise limiter to first af amplifier V606.

a. *Detector V603A.* Detector V603A es half of a type 12AU7 miniature dual- iode tube connected as a half-wave diode ctifier. The 455-kc if. signal developed ross inductor L603 is applied to the thode of V603A. Diode-connected V603A nducts during negative half cycles of the plied if. signal and develops the audio ltage across diode-load resistor R605; pacitor C606 bypasses the rf component the detector output. With the BFO switch ON, the output of beat-frequency oscil- tor V604 is coupled to the V603A cathode rough capacitor C618. The bfo signal is ixed in V603A with the if. input signal and produces an audiofrequency beat note across R605. Jack J615 is a test point.

b. *Noise Limiter V603B.* The noise limiter circuit uses one triode section of a type 12AU7 miniature dual-triode tube, connected as a diode series limiter. With section 2 of function switch S104 in the LIMITER position, noise limiter V603B eliminates peak noise voltages from the audio signal fed from detector V603A to first af amplifier V606. Although noise peaks are generally 10 to 20 times as great as the incoming radio signal, they are normally of short duration. The high-amplitude, short-duration pulses cut off noise limiter V603B and are removed from the audio signal applied to V606 with no noticeable loss in intelligence.

(1) The demodulated signal across resistor R605 is a composite of a negative average dc voltage and the audio component. The cathode of V603B is connected to R605 through resistors R612 and R611. Capacitor C609 couples the audio component to the plate and grid of diode-connected V603B; an audio voltage develops across resistor R608. With V603B connected as above, the plate is positive with respect to the cathode for the full audio signal and the noise limiter diode conducts. Continuous conduction maintains a low plate-to-cathode resistance of V603B and the complete audio component is coupled through capacitor C610, J613-8, and P113-8 to first af amplifier V606. At a function switch setting other than LIMITER, both the audio component and the negative average dc voltage across R605 are applied to the cathode of V603B. Thus, strong negative noise peaks (noise voltages developed across R605 are negative with respect to ground) maintain V603B conduction and are coupled through C610 to first af amplifier V606.

(2) When function switch S104 is set to LIMITER, capacitor C611 is connected between the junction of resistors R611 and R612 and ground



NOTES:

1. UNLESS OTHERWISE SHOWN: RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. BAND WIDTH SWITCH S501 SHOWN IN THE 4KC POSITION.
3. SWITCH IS VIEWED FROM END OPPOSITE THE DRIVEN END.

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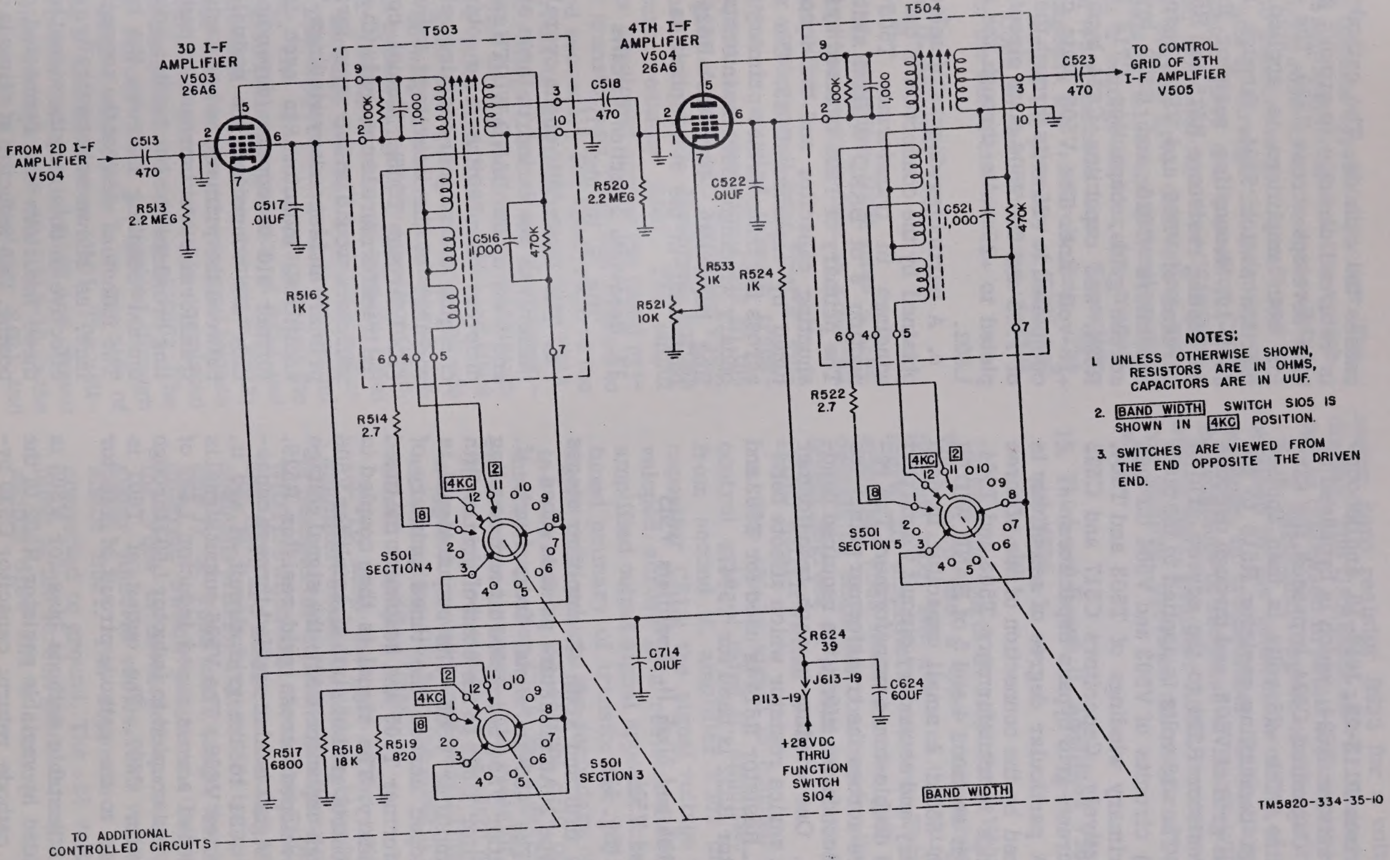
Figure 11. Fifth and sixth if. amplifiers V505 and V506, simplified schematic diagram.



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. BAND WIDTH SWITCH S105 IS SHOWN IN 4KC POSITION.
3. SWITCHES ARE VIEWED FROM THE END OPPOSITE THE DRIVEN END.

Figure 10. Third and fourth if. amplifiers V503 and V504, simplified schematic diagram.

comprises P113-19, J613-19, and decoupling resistor R624, which is bypassed by C714. Capacitor C624 bypasses the +28-volt line. The +28 volts is then applied through decoupling resistor R516 to the screen grid of V503, and through decoupling resistor R524 to the screen grid of V504. The +28 volts is applied to the plate (pin 5) circuits of V503 and V504 through the primary windings of T503 and T504, respectively. Capacitors C517 and C522 are screen-grid bypass capacitors.

c. A particular degree of selectivity is obtained by the connection of one of three windings in transformers T503 and T504, through sections 4 and 5 of BAND WIDTH switch S501. A small capacitor in each primary and secondary circuit forms part of the double-tuned transformer. The resistors across the transformer primaries and secondaries affect the required bandwidth. One winding in each transformer has a series resistor which affects bandwidth. Resistor R514 is used for T503 and resistor R522 is used for T504.

16. Fifth and Sixth If. Amplifiers V505 and V506

(fig. 11)

The fifth and sixth if. amplifier stages use type 26A6 miniature pentode tubes.

a. The 455-kc signal from fourth if. amplifier V504 is coupled through coupling capacitor C523 to the control grid of fifth if. amplifier V505. The output signal is developed across the tuned primary of transformer T505 and coupled to the tuned secondary. The signal is then coupled to the control grid of sixth if. amplifier V506 through capacitor C527; the signal voltage is developed across grid resistor R529. (The signal is also applied through capacitor C631 to the grid circuit of agc if. amplifier V609.) The V506 output signal is developed across tuned inductor L602 of T601 and coupled to inductor L603 through capacitor C602. The output of T601 is applied to the cathode circuit of detector V603A.

b. Adjustable cathode bias for V505 is provided by variable resistor R532 in the V505 cathode return; capacitor C530 bypasses the cathode. The cathode of V506 is returned directly to ground; grid-leak bias develops across R529. The +28 volts for both amplifiers is applied through function switch S104, through P113-19, J613-19, decoupling resistor R624, and decoupling resistors R528 and R531 to the screens of V505 and V506, respectively; capacitors C526 and C529 bypass the screen grids, capacitor C714 bypasses R624, and capacitor C624 bypasses the +28-volt line. The V505 plate circuit is completed to +28 volts through the primary of T505 and the V506 plate circuit is completed to +28 volts through the indicator L602.

c. A particular degree of selectivity is obtained by the connection of one of three windings in transformer T505 through section 6 of BAND WIDTH switch S501. The primary of T505 is tuned by the small shunting capacitor and the secondary is tuned by capacitor C525. The resistors across the transformer primary and secondary windings affect the interstage coupling bandwidth. Resistor R526 affects bandwidth in the 8 KC position of S501.

17. Bandwidth Selection Circuits

(fig. 9, 10, and 11)

a. The bandwidth of the overall if. amplifier can be varied in three steps (2, 4 and 8 kc) by the BAND WIDTH switch. The different bandwidths are obtained by changing the mutual coupling between the windings of the interstage transformers (T501 through T505). Mutual coupling in the transformers is changed with additional inductors wound on the same forms as the primary and secondary windings. The three additional inductors in each if. transformer aid or oppose (depending on how they are connected) the mutual coupling between the primary and secondary of the transformer. An increase in mutual coupling broadens the bandwidth; a decrease in mutual coupling narrows the bandwidth. The inductors nearest the secondary windings, as shown schematically, are most effective in obtaining the widest bandwidth; these inductors are connected phase opposing. One inductor at a time is connected

is the cathode bypass capacitor. The
olts is applied through function switch
, P113-19, J613-19 and resistors R624
R506 to the screen grid (pin 6) and to
plate (pin 5) through the primary of
. Resistor R506 and capacitor C506
resistor R624 and capacitor C714 form
and screen-grid decoupling net-
s. Resistor R106 and potentiometer
form a voltage divider for manual
rol of V501 cathode bias. Capacitor
bypasses the +28-volt line. The
citor across the primary of T501 and
citor C505 in the secondary of T501
part of the tuned circuits.

Second If. Amplifier V502
(fig. 9)

cond if. amplifier V502 uses a type
miniature pentode tube as a 455-kc
age amplifier.

The 455-kc signal from first if. am-
er V501 is coupled through trans-
ner T501 and capacitor C507 to the
rol grid of second if. amplifier V502;
signal voltage is developed across
-return resistor R507. The output
al is developed across the tuned pri-
y of transformer T502 and coupled to
tuned secondary for application to the
circuit of third if. amplifier V503.

Agc voltage from rf and if. agc recti-
V602A is applied to the grid through
stors R508 and R507; R508 and C508
n a grid decoupling network. Cathode
is developed across resistor R509,
ch is bypassed for rf by capacitor C509.
ctor L506 prevents if. signals from
ving through CARRIER LEVEL meter
01. The suppressor grid is at ground
ential. The +28 volts is applied to the
een grid from the junction of R624 and
6 through decoupling resistor R512;
acitor C512 is the screen-grid bypass
acitor. The plate circuit is completed
ough the primary winding of T502. The
tage across R509 is applied through
6, J613-7 and P113-7, to one side of
RRIER LEVEL meter M101. The volt-
between the arm of R662 and ground
pplied through J613-10, P113-10, to the
er side of M101. Resistor R621 and meter zero resistor R622 for a voltage divider. The CARRIER LEVEL meter circuit is discussed in detail in paragraph 21.

c. A particular degree of selectivity is obtained by the connection of one of thee windings in transformer T502, through the contacts of section 2 of BAND WIDTH switch S501. Resistor R510, in series with one winding, provides the required bandwidth.

15. Third and Fourth If. Amplifiers V503 and V504
(fig. 10)

Third and fourth if. amplifiers V503 and V504 each use a type 26A6 miniature pentode tube. The gains of the third and fourth if. amplifiers are low. Third if. amplifier V503 maintains the gain of the overall if. amplifier constant for the different degrees of selectivity chosen with BAND WIDTH switch S501.

a. The 455-kc signal is coupled to the control grid of third if. amplifier V503 from second if. amplifier V502 through capacitor C513; the signal voltage is developed across grid resistor R513. The amplified output signal appears across the tuned primary of transformer T503. The signal induced into the secondary of T503 is coupled to the control grid of V504 through capacitor C518; the signal voltage is developed across grid resistor R520. The amplified signal at the plate of V504 is applied through tuned transformer T504 and capacitor C523 to the control grid of fifth if. amplifier V505.

b. To keep the gain of the overall if. amplifier constant, cathode bias for V503 is changed for different positions of BAND WIDTH switch S501. Resistors R517, R518, and R519 are connected through section 3 of BAND WIDTH switch S501 to the cathode (pin 7) of V503 and change the bias for different switch positions. Cathode bias for V504 is developed across fixed resistor R533 in series with variable resistor R521. The suppressor grids are connected to ground. The +28 volts is applied to the screen grids through function switch S104 and a common circuit that

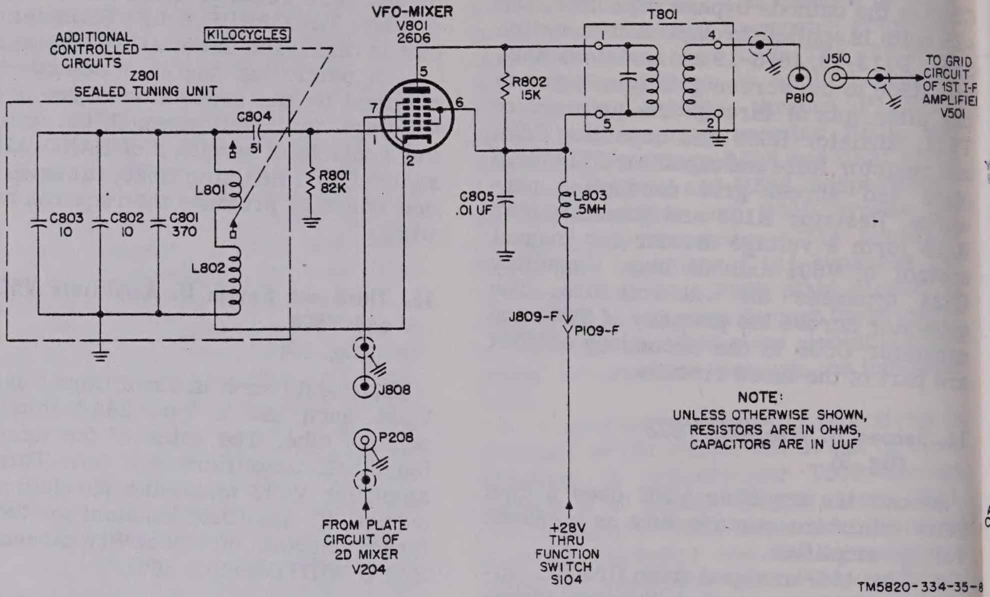


Figure 8. Vfo-mixer, simplified schematic diagram.

V609. The output signal of the sixth if. amplifier is demodulated (detected) in detector V603A. The gain of the if. amplifier section is controlled manually by the RF GAIN SQUELCH THRESH control and automatically by the agc circuits when the AGC switch is set to ON or CAL. To prevent oscillations that may occur from coupling between if. stages through the common impedance of the power source, decoupling networks are used in the screen grid and plate circuits of all if. amplifier stages. Three degrees of selectivity (2, 4, or 8 kc) are obtained by varying the coupling between the primary and secondary windings of the if. transformers with tertiary windings connected into the circuit by the BAND WIDTH switch.

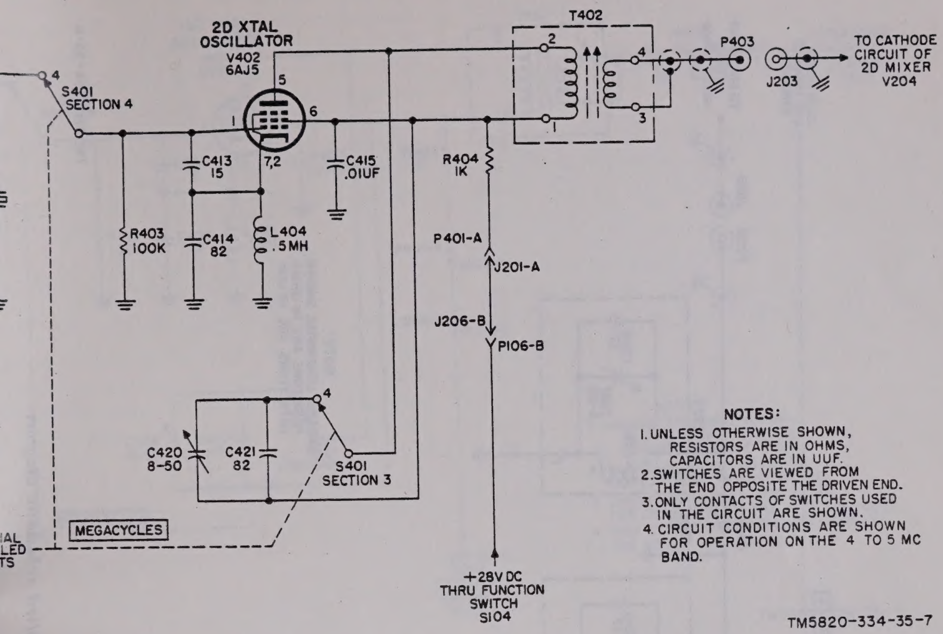
13. First If. Amplifier V501
(fig. 9)

First if. amplifier V501 uses a type 26A6 miniature pentode tube as a 455-kc voltage amplifier.

a. The 455-kc signal from vfo-mixer V801 is coupled through P810, J510, and capacitor C501 to the control grid (pin 1) of first if. amplifier V501; the signal voltage is developed across grid-return resistor R501. The V501 amplified output signal develops across the tuned primary of transformer T501 and is inductively coupled to the tuned secondary for application to second if. amplifier V502.

b. A particular degree of selectivity is obtained by connecting a winding of transformer T501 through the contacts of section 1 of BAND WIDTH switch S501. Series resistor R504 provides proper bandwidth in the 8 KC position of S501.

c. Agc voltage from rf and if. agc rectifier V602A is applied to the grid (pin 1) through resistor R502 and grid resistor R501. Resistor R502 and capacitor C502 form a grid decoupling filter. The gain of the stage is manually controlled by varying the cathode bias with RF GAIN SQUELCH THRESH control R105. Cathode bias is applied through P113-6, J613-6, and L531;



NOTES:
1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. SWITCHES ARE VIEWED FROM THE END OPPOSITE THE DRIVEN END.
3. ONLY CONTACTS OF SWITCHES USED IN THE CIRCUIT ARE SHOWN.
4. CIRCUIT CONDITIONS ARE SHOWN FOR OPERATION ON THE 4 TO 5 MC BAND.

Figure 7. Second crystal oscillator, simplified schematic diagram.

in tuning unit Z801 and coupling gy to the grid (pin 1) through capaci- 804. The screen grid is maintained ground potential by C805. The screen minimizes undesired coupling by ding the oscillator grid from the mixer . The suppressor connects to the cath- The 455-kc signal selected at the is the difference of the incoming al frequency and the oscillator signal uency.

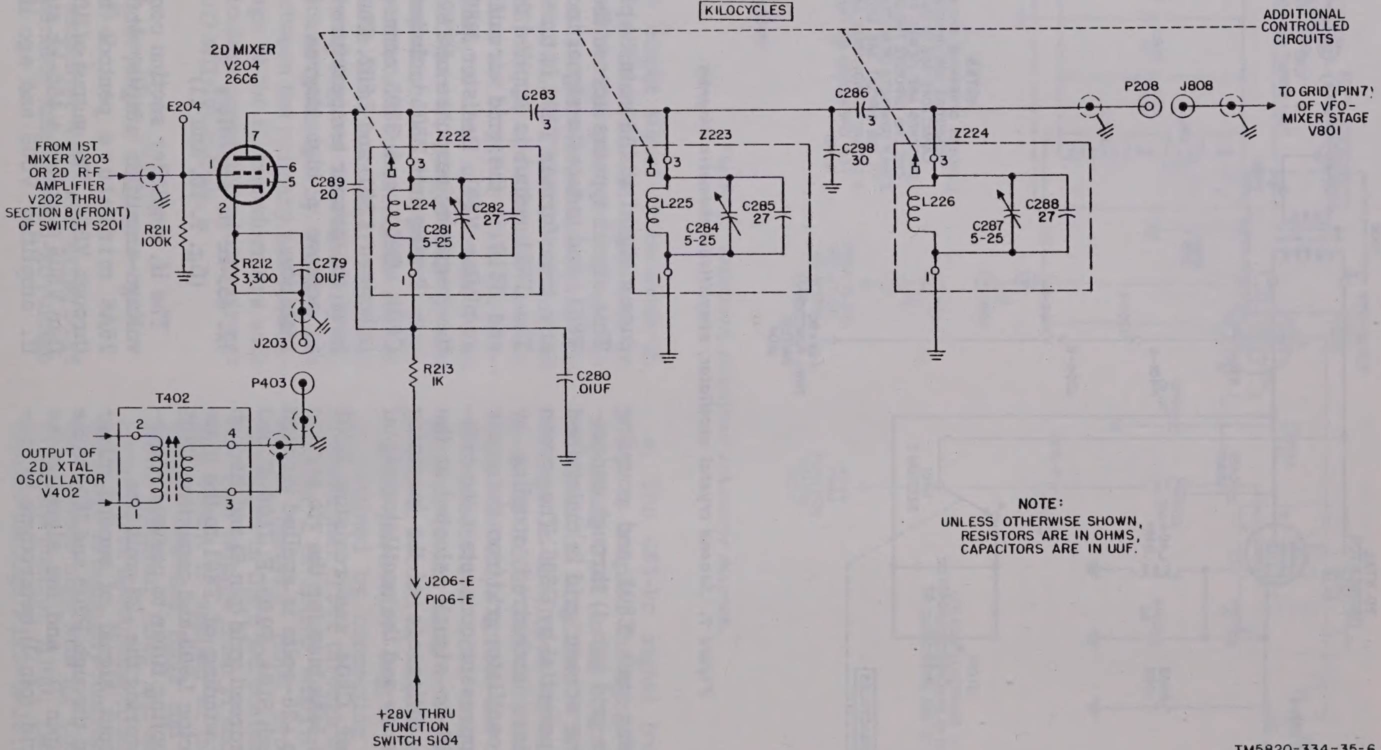
Capacitor C804 and resistor R801 ide grid-leak bias for the vfo section 801. The +28-volts is applied through tion switch S104, P109-F, J809-F, and 3 to the screen grid (pin 6) and through primary winding of T801 to the plate 5). Inductor L803 and capacitor C805 n a decoupling filter to prevent rf cur- from entering the +28-volt line.

The output signal of second mixer 4, applied through P208 and J808 to the er grid (pin 7), and the signal at the illator grid (pin 1) heterodyne to produce a signal at 455 kc in the plate circuit. This signal appears across the primary of T801, and induces a signal in the secondary; transformer T801 is tuned to 455 kc. The T801 output is applied through P810 and J510 to the grid circuit of first if. amplifier V501. Resistor R802 broadens the frequency response of T801.

c. Tuning unit Z801 includes capacitors C801, C802, and C803 connected across inductors L801 and L802. The capacitors have the proper temperature coefficients to achieve a high degree of frequency stability.

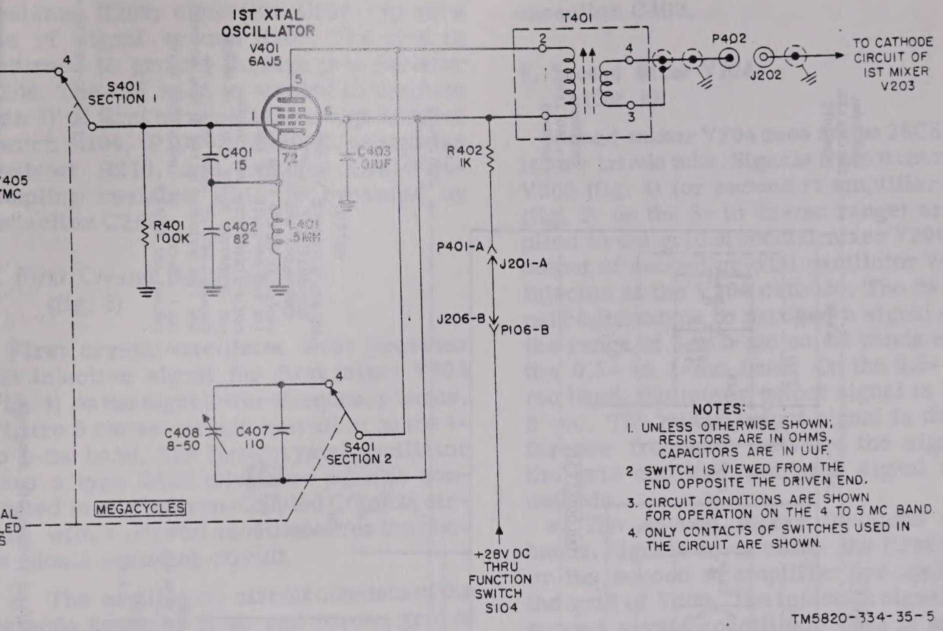
12. 455-kc If. Amplifiers
(fig. 9, 10, and 11)

The if. amplifier section consists of six voltage-amplifier stages, which use type 26A6 miniature pentode tubes, V501 through V506. The output of fifth if. amplifier V505 supplies a 455-kc signal to sixth if. amplifier V506 and agc if. amplifier



NOTE:
UNLESS OTHERWISE SHOWN,
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

Figure 6. Second mixer V204, simplified schematic diagram.



NOTES:
1. UNLESS OTHERWISE SHOWN; RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. SWITCH IS VIEWED FROM THE END OPPOSITE THE DRIVEN END.
3. CIRCUIT CONDITIONS ARE SHOWN FOR OPERATION ON THE 4 TO 5 MC BAND.
4. ONLY CONTACTS OF SWITCHES USED IN THE CIRCUIT ARE SHOWN.

Figure 5. First crystal oscillator, simplified schematic diagram.

inductor L224. Decoupling in the plate circuit is accomplished by resistor R213 and capacitor C280. Grid voltage measurements can be made at test point E204.

10. Second Crystal Oscillator V402
(fig. 7)

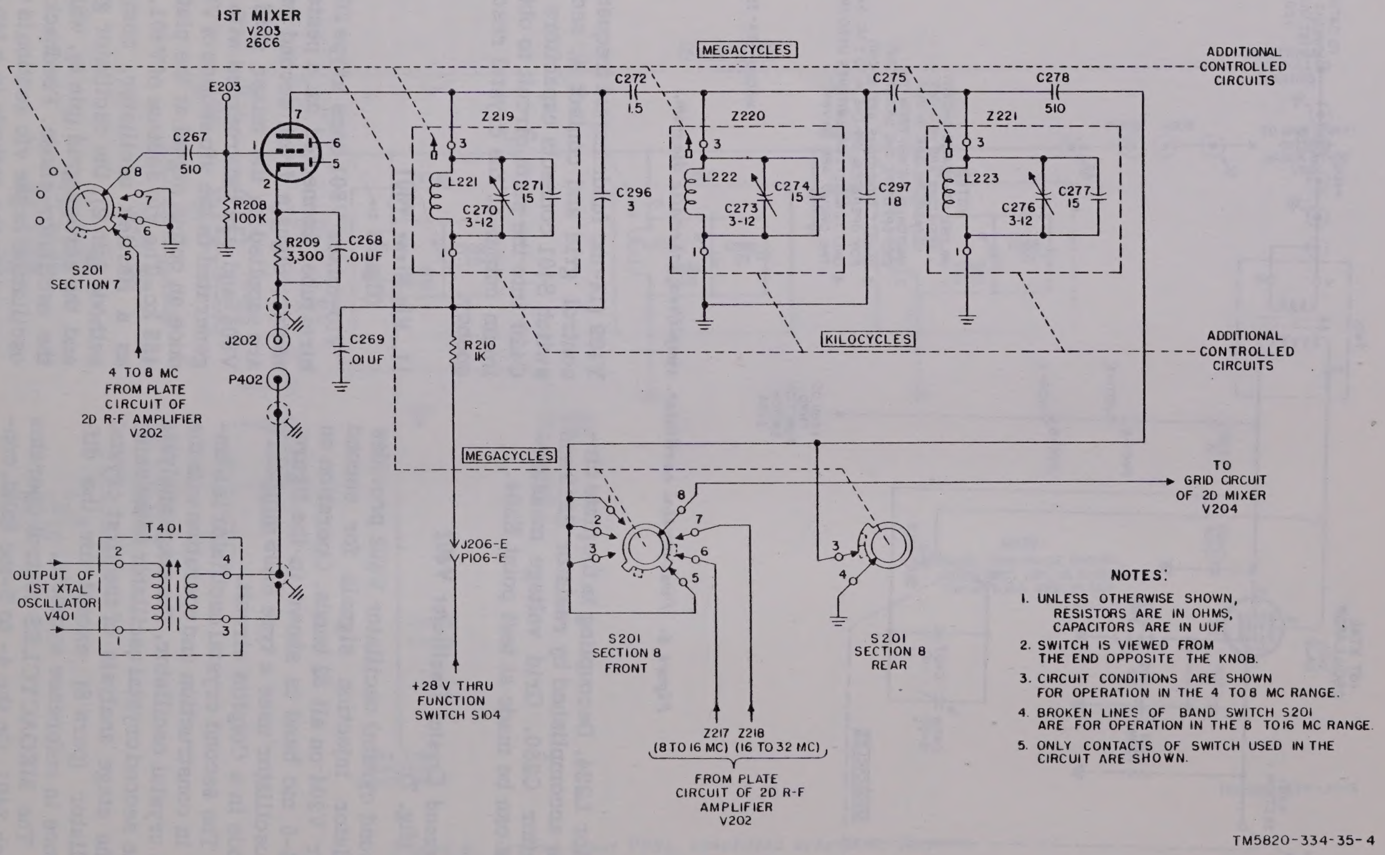
Second cyrstal oscillator V402 provides oscillator injection signals for second mixer V204 on all 32 bands. Operation on the 4-5 mc band is shown in the figure. The oscillator uses a type 6AJ5 miniature pentode in a Colpitts circuit.

a. The second crystal oscillator is identical in construction and operation with the first crystal oscillator. The stage analysis of the second crystal oscillator is the same as the stage analysis of the first crystal oscillator (para 8) except for the difference in reference symbols.

b. The MEGACYCLES control operates switch S401. On the 4- to 5-mc band, contact 4, section 4 of switch S401 connects Y409 (14-mc fundamental frequency) to the control grid and contact 4, section 3 of switch S401 connects capacitors C421 and C420 into the plate circuit to obtain maximum output at the crystal resonant frequency.

11. Vfo-Mixer V801
(fig. 8)

Vfo-mixer V801 uses a type 26D6 miniature tube, connected as a pentagrid converter. Signals from second mixer V204 are applied to the mixer grid (pin 7) of V801 and are heterodyned with the signal generated in the vfo section of V801 to produce an output signal at the plate (pin 5) of 455 kc. The vfo section of V801, connected as a Hartley oscillator, comprises the cathode (pin 2), the oscillator grid (pin 1), and the screen grid (pin 6), which acts as the oscillator anode. Feedback to sustain oscillation in the vfo section is obtained by connecting the cathode to a tap on inductor



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. SWITCH IS VIEWED FROM THE END OPPOSITE THE KNOB.
3. CIRCUIT CONDITIONS ARE SHOWN FOR OPERATION IN THE 4 TO 8 MC RANGE.
4. BROKEN LINES OF BAND SWITCH S201 ARE FOR OPERATION IN THE 8 TO 16 MC RANGE.
5. ONLY CONTACTS OF SWITCH USED IN THE CIRCUIT ARE SHOWN.

Figure 4. First mixer stage, simplified schematic diagram.

b. Cathode bias is developed across esistor R209; capacitor C268 bypasses he rf signal around R209. The grid is eturned to ground through grid resistor R208. The +28 volts is applied to the plate pin 7) of first mixer V203 through function witch S104, P106-E, J206-E, decoupling esistor R210, and inductor L221. Decoupling resistor R210 is bypassed by apacitor C269.

. First Crystal Oscillator V401
(fig. 5)

First crystal oscillator V401 provides he injection signal for first mixer V203 fig. 4) on the eight lower-frequency bands. igure 5 shows circuit operation on the 4- o 5-mc band. The first crystal oscillator ses a type 6AJ5 miniature pentode conected in an electron-coupled Colpitts ciruit, with a crystal substituted for the conentional resonant circuit.

a. The oscillatory circuit consists of the athode, control grid, and screen grid of ube V401; the screen grid acts as the scillator anode. The control grid is con ected to crystal Y405 through contact 4, ection 1 of switch S401. The signal voltage eedback loop is from the screen grid (or node) through capacitor C403 to ground nd then to the control grid circuit; oscilations are sustained at the fundamental rystal frequency of 7 mc for the 4- to -mc band. The amplitude and stability of he oscillations are determined by the alues of capacitors C401 and C402. The irect-current (dc) return for the cathode s inductor L401. Trimmer capacitor C408 nd fixed capacitor C407 are connected, hrough contact 4 of section 2 of switch S401, across the primary of T401 and esonate T401. The output signal is transormer-coupled by T401 through P402 and J202 to the cathode of first mixer tube V203.

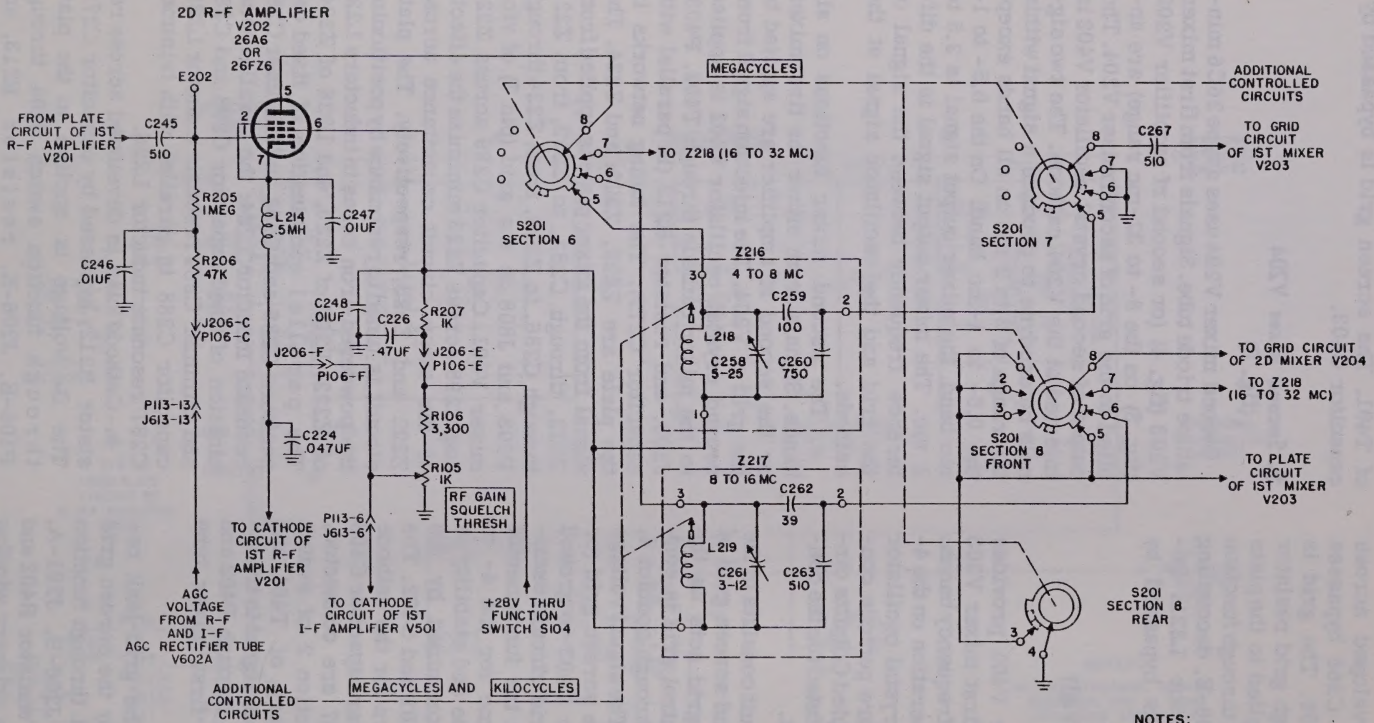
b. Resistor R401 is the grid-leak reistor. The +28 volts for the screen grid nd the plate is applied through function witch S104, P106-B, J206-B, J201-A, P401-A, and decoupling resistor R402 and o the plate through the primary winding of T401. The screen grid is bypassed by capacitor C403.

9. Second Mixer V204
(fig. 6)

Second mixer V204 uses a type 26C6 miniature triode tube. Signals from first mixer V203 (fig. 4) (or second rf amplifier V202 (fig. 3) on the 8- to 32-mc range) are applied to the grid of second mixer V204. The output of second crystal oscillator V402 is injected at the V204 cathode. The two signals heterodyne to produce a signal within the range of 3 to 2 mc on all bands except the 0.5- to 1-mc band. On the 0.5- to 1-mc band, the mixer output signal is 2.5 to 2 mc. The mixer output signal is the difference frequency between the signal of the grid and the oscillator signal at the cathode.

a. The second mixer functions on all bands. Signals from either the first mixer or the second rf amplifier are applied to the grid of V204. The injection signal from second crystal oscillator V402 is applied to the mixer cathode through T402, P403, J203, and resistor R212 (in parallel with capacitor C279). The tuning networks in the plate are Z222, Z223, and Z224. The signal from the mixer plate is applied from Z222, through C283, to Z223, from Z223 through C286, to Z224, from Z224 through P208 and J808 to the grid (pin 7) of vfo-mixer V801. Capacitor C289 across Z222 and C298 across Z223 minimize the effects of the stray circuit capacitance across Z222 and Z223, respectively. The plate circuit is tuned to resonance by positioning the powdered-iron cores in inductors L224 of Z222, L225 of Z223, and L226 of Z224. The parallel combination of fixed capacitors C289 and C282 and trimmer C281 resonate inductor L224; the parallel combination of fixed capacitor C298 and C285 and trimmer C284 resonate inductor L225; capacitor C288 in parallel with trimmer C287 resonate inductor L226.

b. Cathode bias is developed across resistor R212, bypassed by capacitor C279. The B+ voltage is applied to the plate through function switch S104 through P106-E, J206-E, resistor R213, and



NOTES:

1. UNLESS OTHERWISE SHOWN:
   CAPACITORS ARE IN UUF,
   RESISTORS ARE IN OHMS.
2. CIRCUIT CONDITIONS ARE SHOWN FOR OPERATION IN THE 4 TO 8 MC RANGE.
3. POSITION OF BAND SWITCH S201 FOR OPERATION IN THE 8 TO 16-MC RANGE ARE SHOWN IN DOTTED LINES.
4. ONLY CONTACTS OF SWITCHES USED IN THE CIRCUIT ARE SHOWN.
5. ALL SWITCHES ARE VIEWED FROM THE END OPPOSITE THE KNOB.

TM5820-334-35-3

Figure 3. Second rf amplifier, simplified schematic diagram.

206-F, P106-F, and potentiometer R105.
nductor L214 and capacitor C224 decouple
he cathode circuit from the first if. am-
lifier for rf. Capacitor C247 is the cathode
ypass. RF GAIN SQUELCH THRESH con-
rol R105 is common to the first and
econd rf amplifier stages and the first
f. amplifier stage. The +28 volts is ob-
ained through function switch S104 and
pplied to the screen grid (pin 6) of V202
rom function switch S104 and resistor
207. Plate voltage is applied from the
creen grid of V202 through inductor L218
nd the contacts on band switch S201, sec-
ion 6. The screen grid is bypassed by
apacitor C248; R207 is a screen and plate
ecoupling resistor.

c. When the receiver operates within the
- to 16-mc or 16- to 32-mc range, the
irst mixer is not used. Operation in the
- to 16-mc range is shown by the broken
ines of band switch S201. Operation in the
16- to 32-mc range is similar to that in
he 8- to 16-mc range. The rf signal at
he plate of the second amplifier is applied
hrough the contacts (broken line) of section
of band switch S201 to tuning network
217. Capacitor C262 and C263 form a
oltage divider; only the portion of the
oltage appearing across inductor L219 is
pplied through section 8 (front) of band
witch S201 to the grid circuit of second
mixer V204. The input to first mixer V203
s grounded through coupling capacitor
267 and section 7 of band switch S201. The
utput of first mixer V203 is grounded
hrough section 8, rear, of band switch
201; thus, the tuning networks for fre-
uencies between 0.5 and 8 mc are in-
perative, when the 8- to 16-mc and 16-
o 32-mc ranges are used.

d. Selection of the output circuit of the
econd rf amplifier is made by S201 which
s operated by the MEGACYCLES control.
The frequency range of each tuning network
s as follows: Z213, 0.5 to 1 mc; Z214, 1 to
mc; Z215, 2 to 4 mc; Z216, 4 to 8 mc;
217, 8 to 16 mc; and Z218, 16 to 32 mc.
Triple conversion is used in the frequency
range from 0.5 to 8 mc, and double con-
version is used in the frequency range from
to 32 mc. Test point E202 provides an
accessible connection to the grid for testing.

7. First Mixer V203
(fig. 4)

First mixer V203 uses a type 26C6 miniature triode tube. The second rf amplifier output is applied to the control grid (pin 1) and the output of first cyrstal oscillator V401 is applied to the cathode (pin 2). The two signals are heterodyned to produce a signal between 9 and 18 mc in the plate circuit. The frequency of the mixer output signal is variable, and is the sum of the frequencies of the two input signals. In the frequency range from 8 to 32 mc, the input and output of the first mixer are grounded. This is indicated in figure 4 by the broken lines of band switch S201.

a. The first mixer is used only over the 0.5- to 8-mc range. Throughout the 0.5- to 8-mc range, the signal voltage from second rf amplifier V202 is applied through section 7 of band switch S201 to the control grid of first mixer V203. The signal from first crystal oscillator V401 is at a fixed frequency for each band within the 0.5- to 8-mc range and is applied through T401, P402, J202, and resistor R209 (in parallel with capacitor C268) to the cathode of V203. The first mixer plate circuit is tuned by moving the powdered-iron cores within the inductors of Z219, Z220, and Z221. Capacitor C271, C296, C274, C297, and C277 provide fixed capacity for the tuning networks. Capacitors C270, C273, and C276 are trimmer capacitors. The output signal from first mixer V203 is applied from Z219 through C272 to Z220, from Z220 through C275 to Z221, from Z221 through C278 and section 8 (front) of band switch S201 to the grid of second mixer V204. In the 0.5- to 8-mc range, the front of section 8 of S201 connects the output of the first mixer to the second mixer; and in the 8- to 32-mc range, the front of section 8 of S201 connects the output of second rf amplifier V202 to the second mixer. The rear of section 8 of S201 grounds the output of the first mixer during operation within the 8- to 32-mc band (indicated by dotted lines on section 8 of S201).

5. First Rf Amplifier V201
(fig. 2)

First rf amplifier V201 uses a type 26A6 or 26FZ6 miniature pentode tube. The following discussion is concerned only with the 4- to 8-mc range.

a. Signals from the antenna circuit are applied through the contacts of section 2 (rear) of band switch S201 to the control grid of first rf amplifier V201. The amplified signals at the plate of V201 are applied to tuned circuit Z210. The output from V201 is taken at the junction of capacitors C237 and C238; the series-connected capacitors form a voltage divider across inductor L211. This circuit arrangement reduces loading and minimizes any detuning that results from tube-capacitance variation in the following stage. The output of V201 is applied through section 5 of band switch S201 and coupling capacitor C245 to the grid circuit of second rf amplifier V202. Inductor L211 is tuned by the MEGACYCLES and KILOCYCLES controls. Capacitor C236 is an alignment trimmer capacitor.

b. When the AGC switch is set to ON, bias for first rf amplifier V201 is supplied from first rf agc rectifier V601B through J613-3, P113-3, P106-K, J206-K, agc filter resistor R202 (bypassed by capacitor C201), inductor L238 of tuning network Z204A, and the contacts of section 2 (rear) of switch S201. First rf agc rectifier V601B supplies agc voltage to V201 only. Separate agc is fed to V201 to minimize receiver blocking (para 20). Positive voltage is applied from RF GAIN SQUELCH THRESH potentiometer R105 through P106-F, J206-F, and inductor L207 to the cathode of V201. This variable bias voltage provides manual gain control for V201. Capacitor C223 is the cathode bypass capacitor. Potentiometer R105 also controls the gain of second rf amplifier V202 and first if. amplifier V501 (through P113-6 and J613-6); decoupling is provided by L207 and C224. The +28 volts is supplied to the plate and screen grid through function switch S104 and resistor R204. The plate voltage is applied through inductor L211 and the contacts of section 4 of switch S201. Capacitor C226 and resistor R20 prevent rf from entering the +28-volt lin Capacitor C225 is the screen-grid bypas capacitor. Resistor R106 and potent ometer R105 control the bias applied to t cathode of V201.

c. A calibration signal can be applied the grid circuit of V201 through the floo plate contact and coupling capacitor C22 Test point E201 is an accessible conne tion to the grid circuit for testing.

d. Six-position band switch S201, whi is operated by the MEGACYCLES contr selects one of the six tuning networks the output circuit of the first rf amplifie The frequency range of each tuning ne work is as follows: Z207, 0.5 to 1 m Z208, 1 to 2 mc; Z209, 2 to 4 mc; Z210, to 8 mc; Z211, 8 to 16 mc; and Z212, to 32 mc. The core in the inductor of ea tuning network is moved by the MEG CYCLES and KILOCYCLES controls, e cept for the 0.5- to 1-mc and the 1- 2-mc bands, in which the cores are mov by the KILOCYCLES control only.

6. Second Rf Amplifier V202
(fig. 3)

a. The signal from first rf amplifi V201 is applied through coupling capacit C245 to the control grid of second rf ampl fier V202. The amplified signal at t plate of V202 is fed through the contac of section 6 of band switch S201 to tuni network Z216. Capacitors C259 and C2 are connected in series as a voltag divider circuit. The signal takeoff at t junction of C259 and C260 reduces loadi and minimizes detuning. The signal is th applied through section 7 of band swit S201 and coupling capacitor C267 to t grid of first mixer V203.

b. Agc voltage is applied to the grid second rf amplifier V202, from rf and agc rectifier tube V602A, through J61 13, P113-13, P106-C, J206-C, resist R206 and grid-return R205. Resistor R2 and capacitor C246 form an agc filter n work. The cathode (pin 7) and suppress grid (pin 2) are connected together and r turned to ground through inductor L2

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Section II. CIRCUIT ANALYSIS

3. General

a. The circuit analysis follows the signal path established in the block diagram (fig. 1) and the overall schematic diagram (fig. 81). The circuit analysis is limited, in most cases, to operation on the 4- to 8-mc range, because all stages of the receiver are active on this range.

b. Only those switch contacts that are used in a particular circuit are shown in a referenced illustration. All switch contacts are shown in the overall schematic diagram (fig. 81).

4. Antenna Circuit

(fig. 2)

The antenna circuit matches the impedance of different antennas to the input of first if. amplifier V201. The circuit uses a discharge network to protect the receiver against large surges of rf power and accumulated static electrical charges that may be induced in the antenna. A relay in the antenna circuit grounds the receiver during transmission of an associated transmitter (break-in operation) and during receiver calibration (AGC switch at CAL).

a. A whip or long-wire antenna connects to ANT post E101. When the receiver is operated with an associated transmitter, the connection is from the transmitter front panel to ANT receptacle J104. (A single antenna is used for both the transmitter and receiver.) Binding post E101 and connector J104 connect to one of six antenna tuning networks through J106, P206, and section (1) of band switch S201. The six networks tune the antenna for all frequency ranges of the receiver. The network used for a particular range is selected by band switch S201.

b. Signals from the antenna are applied through section 1 of band switch S201 to 4- to 8-mc antenna-tuning network Z204A. ANT TRIM capacitor C202A is used for the 4- to 8-mc range. The primary and secondary of the transformer in Z204A are tuned by variable powdered-iron cores, which are positioned by the MEGACYCLES and KILOCYCLES controls. Capacitor
C310 and C314 provide capacity for resonant circuits. Capacitors C311 and C31
are alignment trimmers, and C312 improves the frequency response characteristics of the transformer. In frequenc
ranges from 0.5 to 2 mc and 16 to 32 mc
single-tuned networks are used. The r
voltage developed across L238 is applie
through switch S201, section 2 (rear) t
the control grid of first rf amplifier V201

c. Section 2 of S201 short-circuit
Z203A, to prevent reactive effects betwee
it and the tuning circuit in use. Antenn
relay K101 grounds the antenna input circuit when either the AGC switch is set t
CAL, the function switch is set to STAN
BY, or during break-in operation when th
receiver is used as part of Radio Set AN
GRC-19. Resistor R102 bleeds off an
static electrical charge on the antenna. I
unusually strong rf currents are induce
in the antenna, such as might be cause
by transmission from an adjacent transmitter, glowlamp I101 conducts and passe
the current to ground.

d. Six-position band switch S201 is operated by the MEGACYCLES control. Whe
the band switch is rotated, the followin
actions occur:

(1) One of six antenna-tuning network
is connected into the input circuit

(2) One or both of the two sections o
ANT TRIM capacitor C202 are connected in the antenna circuit.

(3) One of the unused antenna-tunin
networks is shorted.

e. The antenna circuit covers the frequency range from 0.5 to 32 mc in si
ranges with six tuning networks as follows
0.5 to 1 mc (Z201), 1 to 2 mc (Z202), 2 t
4 mc (Z203A), 4 to 8 mc (Z204A), 8 to 1
mc (Z205A), and 16 to 32 mc (Z206). Th
core within the inductor of each tunin
network is movable and is controlled b
the MEGACYCLES and KILOCYCLES controls, except for the 0.5- to 1-mc and 1-
to 2-mc bands, which are controlled by th
KILOCYCLES control only.

'HRESH control and automatically by two
eparate automatic gain control (agc) cir-
uits. The output of second rf amplifier
'202 is applied to either the first or the
econd mixer, depending on the setting of
ne MEGACYCLES control. For settings
rom 0.5 to 8 mc, the rf signal is mixed-
ith from 0.5 to 8 mc, the rf signal is
nixed with the output of first crystal os-
illator V401 in first mixer V203 to pro-
uce an if. signal from 9 to 18 mc. For
ettings from 8 to 32 mc, the rf signal is
pplied directly from the output of second
f amplifier V202 to second mixer V204.
he heterodyning signal for V204 is sup-
lied by second crystal oscillator V402.
he if. range of the second mixer output
gnal is 3 to 2 mc except for the 0.5 to 1-
c band, where it has a range of 2.5 to 2
c. This variable if. signal is heterodyned
ith the 3,455- to 2,445-kc output of the
scillator portion of variable frequency
scillator-mixer (vfo-mixer) V801 to pro-
uce a fixed 455-kc if.

d. *If. Amplifiers, Bfo, Detector, and*
oise Limiter. The 455-kc output signal of
fo-mixer V801 is applied to first if.
mplifier V501. The if. subchassis con-
ists of six amplifiers, V501 through V506.
hree degrees of bandwidth are selected
y the BAND WIDTH switch. The output of
fth if. amplifier V505 is applied to sixth
. amplifier V506 and agc if. amplifier
'609. The output signal from V506 is de-
nodulated in detector V603A. With the
unction switch set to LIMITER, noise lim-
ter V603B clips the noise peaks from the
etector output signal and applies it to
irst audiofrequency (af) amplifier V606.
No clipping takes place in other function
witch positions. Beat-frequency oscil-
ator (bfo) V604 furnishes a signal within
range from 451 to 459 kc for receiving cw signals and calibrating the receiver. The bfo output is heterodyned with the 455-kc if. signal from sixth if. amplifier V506 to produce an audiofrequency beat note in the detector output.

e. *Audio Amplifiers.* Audio signals from the detector are fed through noise limiter V603B to first af amplifier V606. The output of V606 is applied to phase inverter V607, which provides two equal output voltages 180° out of phase. These two voltages are applied to second af amplifier V608. The output of V608 is to the AUDIO receptacles on the front panel. A sidetone signal is furnished by the transmitter to the headset or speaker for monitoring the transmitter when the receiver is used as part of Radio Set AN/GRC-19.

f. *Agc and If. Cathode Follower.* Agc if. amplifier V609 is a buffer between fifth if. amplifier V505 and the agc rectifiers and the squelch rectifier and IF OUT connector. The isolation provided by V609 permits reception of radioteletype signals with the BFO switch set to ON. The signal from V609 is rectified in first rf agc rectifier V601B (AGC switch at ON or CAL) and applied as bias to first rf amplifier V201 to automatically control the gain of that stage. Rf and if. agc rectifier V602A provides agc bias for the second rf amplifier and the first and second if. amplifiers. A separate agc system is used for the first rf amplifier to prevent receiver blocking by nearby transmitter signals. This circuit arrangement prevents strong off-tune rf signals in the first rf amplifier from biasing succeeding rf and if. amplifiers through a common agc circuit. If. cathode follower V601A provides a low-impedance output connection (50 ohms) at the IF OUT connector for received frequency-shift radioteletype signals.

CHAPTER 1

THEORY

Section I. BLOCK DIAGRAM

1. Scope

a. This manual covers field and depot maintenance for Radio Receiver R-392/URR. It includes instructions appropriate to third, fourth, and fifth echelons for troubleshooting, testing, aligning, and repairing specified maintenance parts. It also lists tools, materials, and test equipment required for maintenance. Detailed functions of the equipment are covered in this chapter.

b. The complete technical manual for this equipment includes the following other publications: TM 11-5820-334-10, TM 11-5820-334-20, TM 11-5820-334-20P, and TM 11-5820-334-35P.

c. Forward comments concerning this manual to the Commanding Officer, U. S. Army Signal Materiel Support Agency, ATTN: SIGMS-PA2d, Fort Monmouth, N.J.

Note. For applicable forms and records, see paragraph 2, TM 11-5820-334-10.

2. Block Diagram Discussion
(fig. 1)

Radio Receiver R-392/URR is a vehicular receiver that provides reception of voice (amplitude-modulated (am.)), tone-modulated radiotelegraph (modulated continuous wave (mcw)), unmodulated radiotelegraph (continuous-wave (cw)), and frequency-shift, single-channel radioteletype signals within a frequency range of 0.5 to 32 megacycles (mc). The frequency range is covered in 32 bands of 1-mc width each with the exception of the first band (0.5 to 1 mc), which covers 500 kilocycles (kc). An internal calibration oscillator permits accurate calibration of the countertype frequency indicator at 100-kc points throughout the entire frequency range of the receiver. Two receiver outputs are available at the front panel: a 200-milliwatt (ms) audio signal for use with a 600-ohm impedance headset or loudspeaker and a 455-kc intermediate-frequency (if.) signal for use with a 50-ohm impedance frequency-shift, single-channel radioteletype converter. The block diagram shows the signal path from the antenna through the various stages to the output. A schematic diagram (fig. 81) shows details of the circuits in the same order. Radio Receiver R-392/URR obtains both filament and plate circuit voltages directly from a vehicular electrical system or similar electrical supply.

a. Antenna Circuits. Radiofrequency (rf) signals are applied to the receiver from the antenna input. Antenna relay K101 grounds the antenna input during transmission (break-in operation) when the receiver is used with an associated transmitter. This relay is also activated in the receiver standby and calibration functions. The rf signals pass to first rf amplifier V201 through one of several antenna tuning networks, as determined by the operating frequency of the receiver.

b. Calibration Oscillator. The calibration oscillator provides a calibration signal every 100 kc within the frequency range of the receiver when the AGC switch is set to CAL. The 200-kc oscillator (V702) supplies a signal for synchronizing multivibrator V701 at 100 kc. Harmonic amplifier V703A amplifies the harmonics of the multivibrator output to provide a strong calibration signal at the 100-kc points. Distorter V703B further increases the harmonic content of the output of the harmonic amplifier and produces a signal which is applied to the input of first rf amplifier V201.

c. Rf Amplifiers and Mixers. The output of first rf amplifier V201 is coupled to second rf amplifier V202. The gain of the first and second rf amplifiers is controlled manually by the RF GAIN SQUELCH

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*TM 11-5820-334-35/TO 31R1-2URR-422

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DEPARTMENTS OF THE ARMY
AND THE AIR FORCE

WASHINGTON 25, D. C., *21 August 1961*

RADIO RECEIVER R-392/URR

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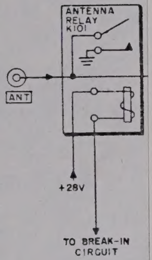
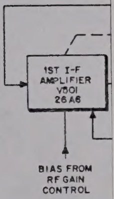
*This manual, together with TM 11–5820–334–10, 7 November 1960 and TM 11–5820–334–20, 27 December 1960, supersedes TM 11–858, 27 April 1954 including C1, 30 December 1955; C2, 26 July 1956; C3 7 December 1956; C4, 7 February 1957; C5, 6 June 1960.


ANTENNA RELAY K101
ANT
+28V
TO BREAK-IN CIRCUIT


1ST I-F AMPLIFIER V501 26A6
BIAS FROM RF GAIN CONTROL

Technical Manual
No. 11-5820-334-34
Technical Order
No. 31R1-2URR-422

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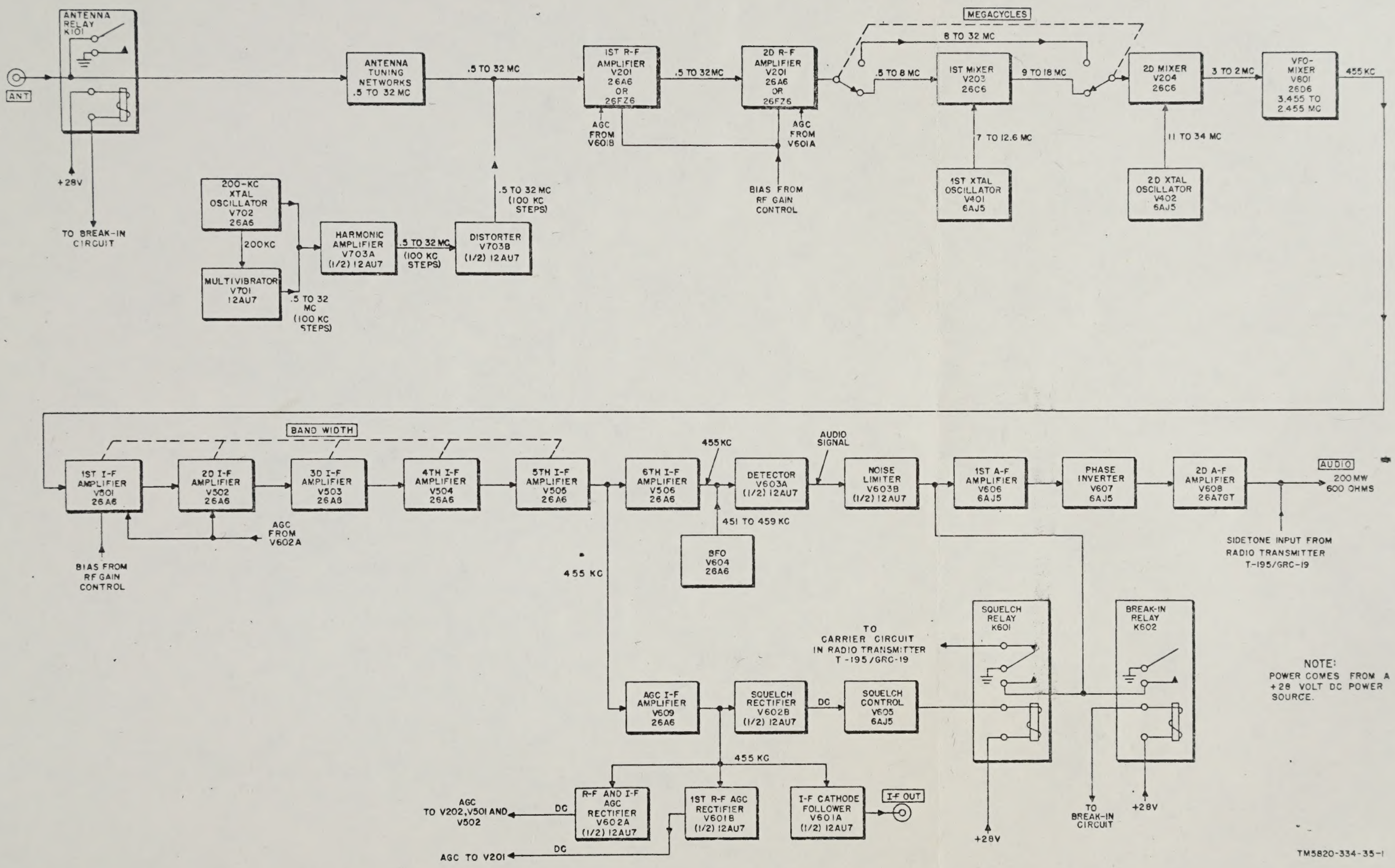
*This manual, together with TM 11-5820-334-10, 7 November 1960 and TM 11-5820-334-20, 27 December 1960, supersedes TM 11-858, 27 April 1954 including C1, 30 December 1955; C2, 26 July 1956; C3 7 December 1956; C4, 7 February 1957; C5, 6 June 1960.


ANT
ANTENNA RELAY K101
+28V
TO BREAK-IN CIRCUIT
ANTENNA TUNING NETWORKS .5 TO 32 MC
.5 TO 32 MC
1ST R-F AMPLIFIER V201 26A6 OR 26FZ6
.5 TO 32 MC
2D R-F AMPLIFIER V201 26A6 OR 26FZ6
AGC FROM V601B
AGC FROM V601A
BIAS FROM RF GAIN CONTROL
MEGACYCLES
8 TO 32 MC
.5 TO 8 MC
1ST MIXER V203 26C6
9 TO 18 MC
2D MIXER V204 26C6
3 TO 2 MC
VFO-MIXER V801 26D6 3.455 TO 2.455 MC
455 KC
7 TO 12.6 MC
1ST XTAL OSCILLATOR V401 6AJ5
11 TO 34 MC
2D XTAL OSCILLATOR V402 6AJ5
200-KC XTAL OSCILLATOR V702 26A6
200 KC
MULTIVIBRATOR V701 12AU7
.5 TO 32 MC (100 KC STEPS)
HARMONIC AMPLIFIER V703A (1/2) 12AU7
.5 TO 32 MC (100 KC STEPS)
DISTORTER V703B (1/2) 12AU7
.5 TO 32 MC (100 KC STEPS)
BAND WIDTH
1ST I-F AMPLIFIER V501 26A6
2D I-F AMPLIFIER V502 26A6
3D I-F AMPLIFIER V503 26A6
4TH I-F AMPLIFIER V504 26A6
5TH I-F AMPLIFIER V505 26A6
BIAS FROM RF GAIN CONTROL
AGC FROM V602A
455 KC
6TH I-F AMPLIFIER V506 26A6
455 KC
DETECTOR V603A (1/2) 12AU7
451 TO 459 KC
BFO V604 26A6
AUDIO SIGNAL
NOISE LIMITER V603B (1/2) 12AU7
1ST A-F AMPLIFIER V606 6AJ5
PHASE INVERTER V607 6AJ5
2D A-F AMPLIFIER V608 26A7GT
AUDIO
200 MW 600 OHMS
SIDETONE INPUT FROM RADIO TRANSMITTER T-195/GRC-19
TO CARRIER CIRCUIT IN RADIO TRANSMITTER T-195/GRC-19
SQUELCH RELAY K601
BREAK-IN RELAY K602
AGC I-F AMPLIFIER V609 26A6
SQUELCH RECTIFIER V602B (1/2) 12AU7
DC
SQUELCH CONTROL V605 6AJ5
455 KC
R-F AND I-F AGC RECTIFIER V602A (1/2) 12AU7
1ST R-F AGC RECTIFIER V601B (1/2) 12AU7
I-F CATHODE FOLLOWER V601A (1/2) 12AU7
I-F OUT
DC
AGC TO V202, V501 AND V502
DC
AGC TO V201
+28V
TO BREAK-IN CIRCUIT
+28V
NOTE: POWER COMES FROM A +28 VOLT DC POWER SOURCE.

TM5820-334-35-1

Figure 1. Radio Receiver R-392/URR, block diagram.

DEPARTMENT OF THE ARMY TECHNICAL MANUAL **TM 11-5820-334-10**

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER **TO 31R1-2URR-421**

OPERATOR'S MANUAL

RADIO RECEIVER R-392/URR

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

7 November 1960

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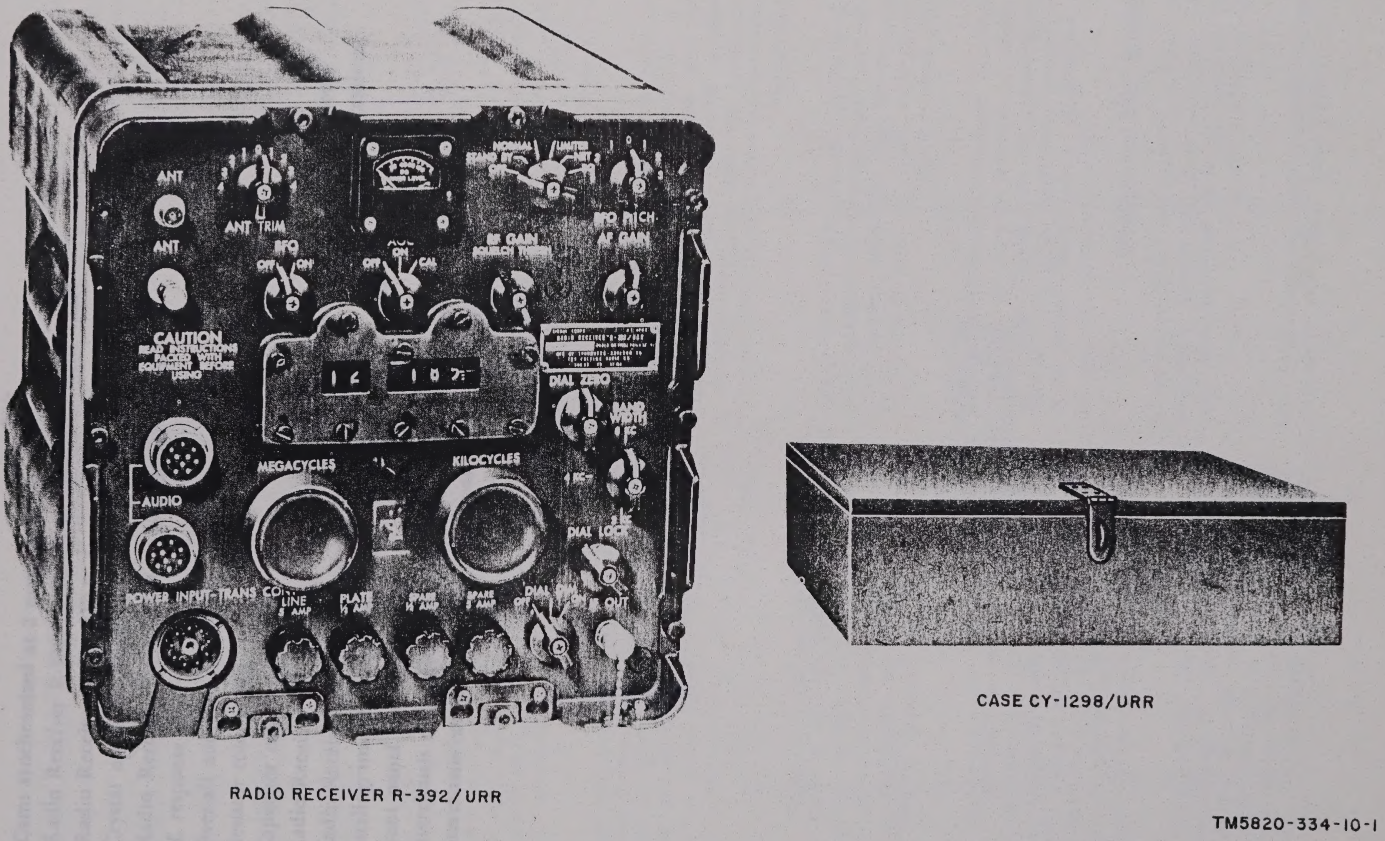

Figure 1. Radio Receiver R-392/URR.

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ARTIFICIAL RESPIRATION

GENERAL PRINCIPLES

1. Seconds count! Begin at once! Don't take time to move the victim unless you must. Don't loosen clothes, apply stimulants or try to warm the victim. Start resuscitation! Get air in the lungs! You may save a life!

2. Place the victim's body in a prone position, so that any fluids will drain from the respiratory passages. The head should be extended and turned sideward *never flexed forward;* the chin shouldn't sag, since obstruction of the respiratory passages may occur.

3. Remove any froth or debris from the mouth with your fingers. Draw the victim's tongue forward.

4. Begin artificial respiration. Continue it rhythmically and without any interruption until natural breathing starts or the victim is pronounced dead. Try to keep the rhythm smooth. Split-second timing is not absolutely essential.

5. When the victim starts breathing, or when additional help is available loosen the clothing; remove it, if it's wet; keep the victim warm. Shock should receive adequate attention. Don't interrupt the rhythmical artificial technique for these measures. Do them only when you have help or when natural breathing has started.

6. When the victim is breathing, adjust your timing to assist him. Don't fight his efforts to breathe. Synchronize your efforts with his. After resuscitation, keep him lying down until seen by a physician or until recovery seems certain.

7. Don't wait for mechanical resuscitation! If an approved model is available, use it, but, since mechanical resuscitators are only slightly more effective than properly performed "push-pull" manual technique, *never* delay manual resuscitation for it.

BACK-PRESSURE ARM LIFT METHOD

1. *Position of Victim.* Place the victim in the prone (face-down) position. Bend his elbows; place one hand upon the other. Turn his face to one side, placing his cheek upon his hands.

2. *Position of Operator.* Kneel on your left or right knee, at the victim's head, facing him. Your knee should be at the side of the victim's head close to his forearm, your foot should be near his elbow. Kneel on both knees if you find it more comfortable, with one knee on each side of the head. Place your hands on the flat of the victim's back so that their heels are just below the lower tip of his shoulder blades. With the tip of your thumbs touching spread your fingers downward and outward. (See A)

3. *Compression Phase.* Rock forward until your arms are approximately vertical and allow the weight of the upper part of your body to exert a slow, steady, even, downward pressure upon your hands. This forces air out of the lungs. Keep your elbows straight and press almost directly downward on the back. (See B)

4. *Expansion Phase.* Release the pressure, avoid any finish thrust, and commence to rock backward slowly. Place your arms upon the victim's arms just above the elbows, and draw his arms upward and toward you. Apply just enough lift to feel resistance and tension at the victim's shoulders.

Don't bend your elbows. As you rock backward, the victim's arms will be drawn toward you. (The arm lift expands the chest by pulling on the chest muscles, arching the back and relieving the weight on the chest.) Drop the arms gently to the ground or floor. This completes the cycle. (See C and D). Now, repeat the cycle.

5. *Cycle Timing and Rhythm.* Repeat the cycle 10 to 12 times per minute. Use a steady uniform rate of Press, Release, Lift, Release. Longer counts of about equal length should be given to the "Press" and "Lift" steps of the compression and expansion phases. Make the "Release" periods of minimum duration.

6. *Changing Position or Operator.*

(*a*) Remember that you can use either or both knees or can shift knees during the procedure, provided you don't break the rhythm. Observe how you rock forward with the back-pressure and backward with the arm-lift. The rocking motion helps to sustain the rhythm and adds to the ease of operation.

(*b*) If you tire and another person is available, you can "take turns." Be careful not to break the rhythm in changing. Move to one side and let your replacement come in from the other side. Your replacement begins the "Press-Release" after one of the "Lift-Release" phases, as you move away.

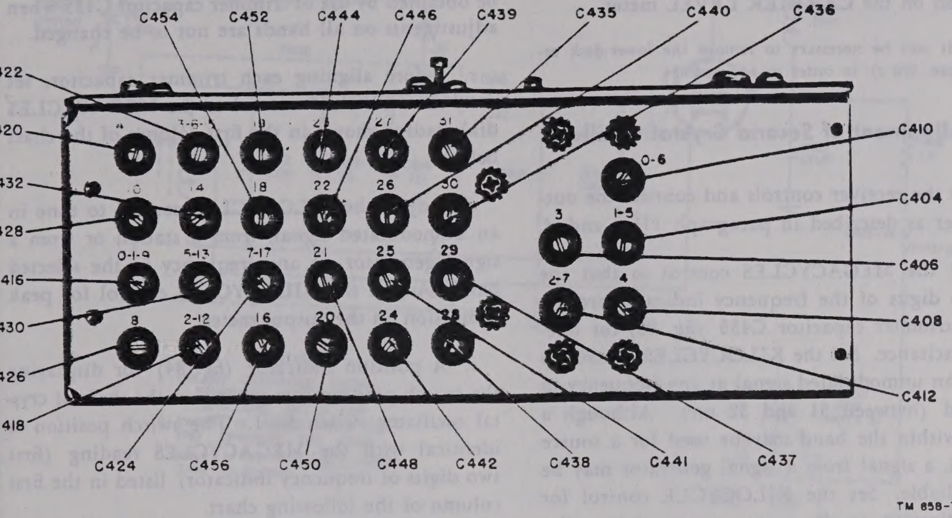


Figure 83. Crystal oscillator trimmers.

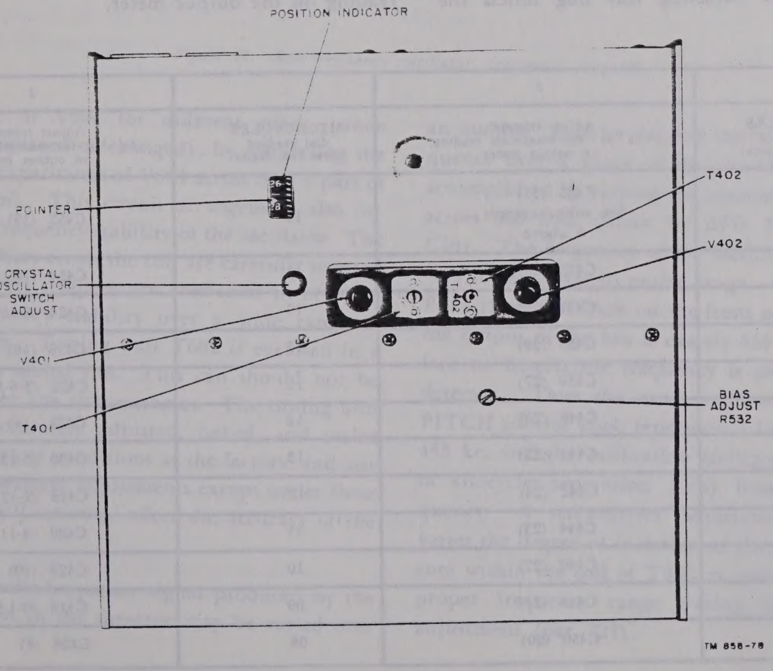


Figure 84. Radio Receiver R-392/URR, case removed, rear view.

k. Set the AGC switch at ON. Adjust capacitor C634 in the plate circuit of V609 (fig. 82) for peak indication on the CARRIER LEVEL meter.

Note. It will be necessary to remove the lower-deck assembly (par. 108 *c*) in order to adjust C634.

116. Alignment of Second Crystal Oscillator

a. Set the receiver controls and connect the output meter as described in paragraph 115 *c* and *d*.

b. Set the MEGACYCLES control so that the first two digits of the frequency indicator are 31. Set the trimmer capacitor C435 (fig. 83) for one-half capacitance. Set the KILOCYCLES control to tune in an unmodulated signal at any frequency in the band (between 31 and 32 mc). Although a station within the band may be used for a source of signal, a signal from a signal generator may be more reliable. Set the KILOCYCLE control for peak indication on the output meter. Adjust the slug of transformer T402 (fig. 60) for peak output. Trimmer capacitors for all other bands must be adjusted after the position of this slug is adjusted. Therefore, avoid adjusting this slug unless the crystal oscillator is to be aligned for all bands. Slight adjustment on the 31- and 32-mc band may be obtained by use of trimmer capacitor C435 when adjustments on all bands are not to be changed.

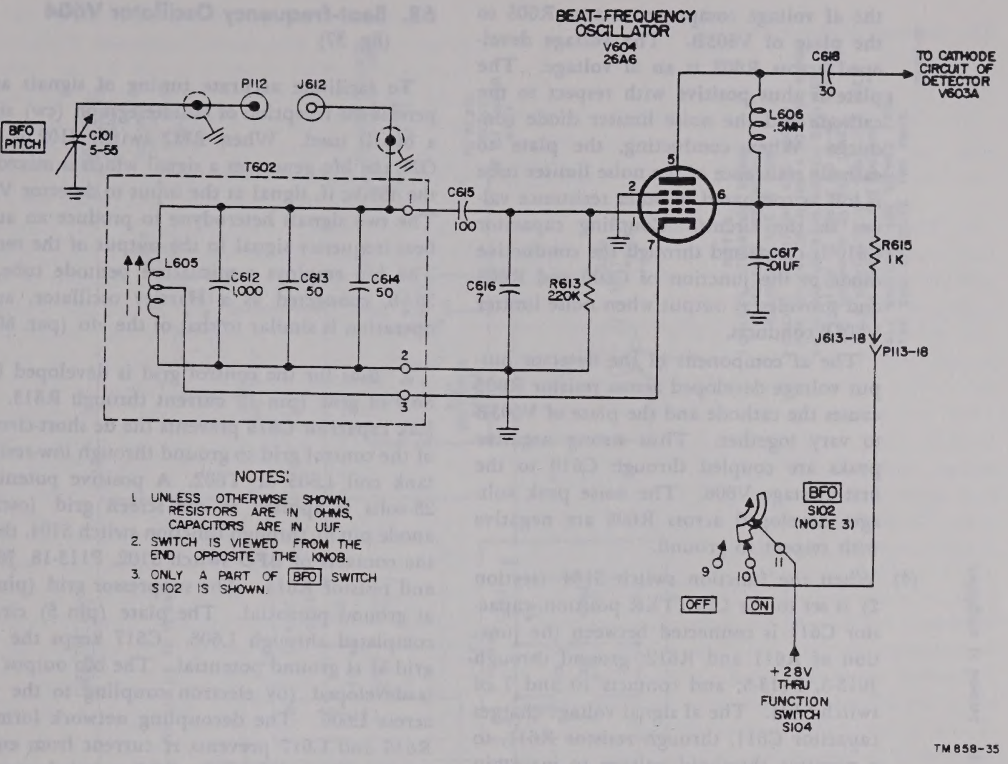
c. Before aligning each trimmer capacitor, set the MEGACYCLES control to the MEGACYCLES dial reading shown in the first column of the chart below.

d. Adjust the KILOCYCLES control to tune in an unmodulated signal, from a station or from a signal generator, at any frequency in the selected band. Adjust the KILOCYCLES control for peak indication on the output meter.

e. A position indicator (fig. 84) for displaying the switch position is mounted on the shaft of crystal oscillator switch S401. The switch position is identical with the MEGACYCLES reading (first two digits of frequency indicator) listed in the first column of the following chart.

f. The trimmer capacitors are listed in the second column in the order in which they are to be adjusted. Adjust each trimmer capacitor for peak reading on the output meter.

1	2	1	2
MEGACYCLES dial reading (first two digits)	Adjust trimmer (fig. 81) for maximum reading on output meter	MEGACYCLES dial reading (first two digits)	Adjust trimmer (fig. 81) for maximum reading on output meter
31	C435 (31) See subparagraph *b* above	19	C452 (19)
30	C436 (30)	18	C454 (18)
29	C437 (29)	17	C424 (7-17)
28	C438 (28)	16	C456 (16)
27	C439 (27)	15	C422 (3-6-15)
26	C440 (26)	14	C432 (14)
25	C441 (25)	13	C430 (5-13)
24	C442 (24)	12	C418 (2-12)
23	C444 (23)	11	C420 (4-11)
22	C446 (22)	10	C428 (10)
21	C448 (21)	09	C416 (0-1-9)
20	C450 (20)	08	C426 (8)



NOTES:
1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. SWITCH IS VIEWED FROM THE END OPPOSITE THE KNOB.
3. ONLY A PART OF BFO SWITCH S102 IS SHOWN.

Figure 37. Beat-frequency oscillator, schematic diagram.

capacitance of V604 for different tubes (when tubes are replaced or changed), by connecting the grid input capacitance of V604 across only a part of the tank coil. This circuit arrangement also improves the frequency stability of the oscillator. The three capacitors across the coil are carefully selected for the correct temperature coefficient in order to assure frequency stability over a wide range of temperatures. Tuning unit T602 is enclosed in a hermetically sealed can. This can should not be opened under any circumstances. The tuning unit has been accurately adjusted, baked, and sealed under laboratory conditions at the factory, and any attempt to perform adjustments except under these conditions will seriously affect the accuracy of the unit.

d. The audio-frequency signal produced by the mixing action in the detector may be varied over an audible range by varying the bfo oscillator frequency over a range of 451 to 459 kc. This is accomplished by varying the amount of capacitance across the tank circuit by BFO PITCH control C101. The frequency of the oscillator is caused to vary linearly over its entire range. When the BFO PITCH control knob on the front panel is set to 0, the output of the bfo is exactly 455 kc; and therefore no heterodyne frequency is produced in the detector. Thus the zero position of the BFO PITCH control knob represents a bfo frequency of 455 kc, and the calibration indicates the number of kilocycles separation (±3) from the bfo frequency. A screw-driver adjustable slug, which varies the degree of insertion of the powdered-iron core within the coil of T602, is used to obtain the proper frequency range during alignment and adjustment (par. 121).

the af voltage component across R605 to the plate of V603B. The voltage developed across R608 is an af voltage. The plate is thus positive with respect to the cathode and the noise limiter diode conducts. When conducting, the plate to cathode resistance of the noise limiter tube is low as compared to other resistance values in the circuit. Coupling capacitor C610 is connected through the conductive diode to the junction of C609 and R608 and provides af output when noise limiter V603B conducts.

The af component of the detector output voltage developed across resistor R605 causes the cathode and the plate of V603B to vary together. Thus strong negative peaks are coupled through C610 to the first af stage V606. The noise peak voltages developed across R605 are negative with respect to ground.

(4) When the function switch S104 (section 2) is set to the LIMITER position, capacitor C611 is connected between the junction of R611 and R612; ground through J613-5, P113-5; and contacts 10 and 7 of switch S104. The af signal voltage charges capacitor C611, through resistor R611, to a negative threshold voltage to maintain a negative potential on the cathode of the noise limiter tube with respect to ground. The charging time of the capacitor is long compared with the duration of noise signal peaks, so that a noise peak can not appreciably change the potential across the capacitor, although the potential at the noise limiter plate can change rapidly. Since the plate and cathode of the noise limiter tube tend to follow the af signal, large negative peaks of signal voltage drive the plate of the noise limiter tube more negative than the cathode, cutting the tube off. This in effect disconnects coupling capacitor, C610, from the junction of C609 and R608, so that the first af amplifier, V606, has no appreciable input for the duration of the noise modulation. R612 serves as the cathode load resistor across which the limiter output voltage is developed when the function switch is set to LIMITER.

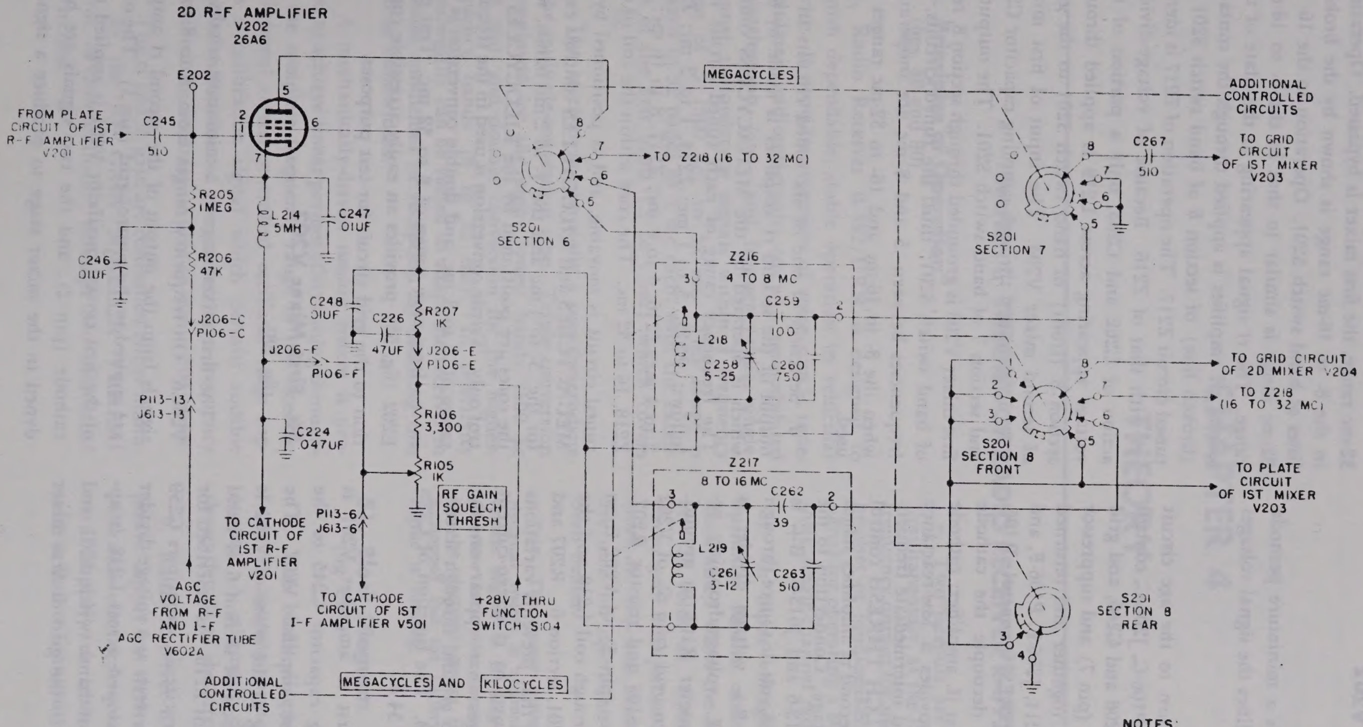
68. Beat-frequency Oscillator V604
(fig. 37)

To facilitate accurate tuning of signals and t permit the reception of radiotelegraph (cw) signals a bfo is used. When BFO switch S102 is set t ON, the bfo generates a signal which is mixed wit the 455-kc if. signal at the input to detector V603A The two signals heterodyne to produce an audibl beat-frequency signal in the output of the receiver The bfo employs a miniature pentode tube, typ 26A6, connected as a Hartley oscillator, and it operation is similar to that of the vfo (par. 60).

a. Bias for the control grid is developed by th flow of grid (pin 1) current through R613. Gri leak capacitor C615 prevents the dc short-circuitin of the control grid to ground through low-resistanc tank coil L605 or T602. A positive potential o 28-volts is applied to the screen grid (oscillato anode pin 6) through function switch S104, throug the contacts of BFO switch S102, P113-18, J613-1 and resistor R615. The suppressor grid (pin 2) i at ground potential. The plate (pin 5) circuit i completed through L606. C617 keeps the scree grid at rf ground potential. The bfo output signa is developed (by electron coupling to the plate across L606. The decoupling network formed b R615 and C617 prevents rf current from enterin the B+ line. When the BFO switch is turned t OFF, B+ is disconnected from the plate and scree circuits of the oscillator.

b. The oscillator section of the tube function as a triode in which the screen grid acts as the plate The control grid is coupled through grid lea capacitor C615 to tuned circuit T602, which con sists of tank coil L605 and tank capacitors C612 C613, and C614, connected in parallel. The cath ode of V604 is connected to a tap on the tank coil The amount of feedback voltage from the oscillato plate circuit to the control grid circuit necessary t sustain oscillations is determined by the position o the tap on the tank coil. Since the oscillator outpu is coupled into the plate circuit by the electron flow within the tube, variations in plate load have little effect on oscillator stability. The amplified signal from the plate is coupled through capacitor C61 to the cathode circuit of detector V603A.

c Capacitors C615 and C616 form a network which minimizes the effects of variation in input



NOTES:
1 UNLESS OTHERWISE SHOWN CAPACITORS ARE IN UUF, RESISTORS ARE IN OHMS.
2 CIRCUIT CONDITIONS ARE SHOWN FOR OPERATION IN THE 4 TO 8 MC RANGE.
3 POSITION OF BAND SWITCH S201 FOR OPERATION IN THE 8 TO 16-MC RANGE ARE SHOWN IN DOTTED LINES.
4 ONLY CONTACTS OF SWITCHES USED IN THE CIRCUIT ARE SHOWN.
5 ALL SWITCHES ARE VIEWED FROM THE END OPPOSITE THE KNOB

TM 858-25

Figure 27. Second rf amplifier.

55. Second Rf Amplifier V202

(fig. 27)

The second rf amplifier is a miniature pentode tube, type 26A6, which amplifies the signal voltages from the first rf amplifier.

a. The grid (pin 1) return to the agc circuit is through J613-13, P113-13, P106-C, J206-C, control grid decoupling network R206 and C246, and grid resistor R205. The cathode (pin 7) and suppressor grid (pin 2) are connected together and returned to ground through choke L214, J206-F, P106-F, and RF GAIN SQUELCH THRESH control R105. L214 and C224 (fig. 26) decouple the cathode (pin 7) circuit from the first if. amplifier; cathode bypass capacitor, C247, provides a low-reactance path to ground at radio and intermediate frequencies. The RF GAIN SQUELCH THRESH control is common to the first and second rf amplifier stages and the first if. amplifier stage. Connection to the latter is made through P113-6 and J613-6. B+ is obtained from an external 28-volt dc source through function switch S104. A B+ voltage divider is completed through P106-E, voltage-dropping resistor R106, and potentiometer R105 to ground. B+ is applied to the screen grid (pin 6) of V202 from the function switch S104 and resistor R207. B+ is applied to the plate (pin 5) of V202 from the screen grid of V202 through coil L218 and the contacts on band switch S201, section 6. R207 and C248 form a filter network that prevents variations of screen-grid voltages caused by rf screen-current change. Rf signal voltages that appear on the screen grid are bypassed to ground through screen-grid bypass capacitor C248. The function of C226 is explained in paragraph 54 *b*.

b. The signal from first rf amplifier V201 is applied through coupling capacitor C245 to the control grid of second rf amplifier V202. The amplified signal appearing at the plate of V202 is applied through the contacts of section 6 of band switch S201 to tuned circuit Z216. As described for the first rf amplifier plate circuit, capacitors C259 and C260 are connected in series as a voltage-divider circuit. The voltage developed across L218 is applied through section 7 of band switch S201 and coupling capacitor C267 to the grid of first mixer V203.

c. When operating in the 8- to 16-mc or 16- to 32-mc range, the first mixer is bypassed. Operation in the 8- to 16-mc range is shown by the broken lines of band switch S201. Operation in the 16- to 32-mc range is similar to that in the 8- to 16-mc range. The rf signal appearing at the plate of the second r-f amplifier is applied through the contacts (broken line) of section 6 of band switch S201 to tuned circuit Z217. The operation of Z217 is identical with that of Z216. Because of voltage-divider action of C262 and C263, only a portion of the voltage appearing across L219 is applied through section 8 (front) of band switch S201 to the grid of second mixer V204. The input of first mixer V203 is grounded through coupling capacitor C267 and section 7 of band switch S201. The output of first mixer V203 is grounded through section 8, rear, of band switch S201; thus, the tuned circuits, for frequencies between .5 and 8 mc are inoperative, when the 8- to 16-mc and 16- to 32-mc ranges are used.

d. Selection of one of six tuned circuits in the output of the second rf amplifier is made by S201 which is operated by the MEGACYCLES control. The frequency range of each tuned circuit is as follows: Z213, .5 to 1 mc; Z214, 1 to 2 mc; Z215, 2 to 4 mc; Z216, 4 to 8 mc; Z217, 8 to 16 mc; and Z218, 16 to 32 mc. The core within the coil of each tuned circuit is movable, and is positioned by the MEGACYCLES and KILOCYCLES controls except for the .5- to 1-mc and the 1- to 2-mc bands, when the cores are positioned by the KILOCYCLES control only. Triple conversion is used in the frequency range of .5 to 8 mc, and double conversion is used in the frequency range of 8 to 32 mc. Test point E202 (fig. 58) provides an easily accessible connection to the grid circuit for test purposes.

56. First Mixer V203

(fig. 28)

The first mixer stage is a miniature triode, type V26C6. On frequency ranges from .5 to 8 mc the signals from the output of the second rf amplifier are applied to the control grid (pin 1). The output of the first crystal oscilator V401 is applied to the cathode (pin 2), and the two signals are heterodyned in the mixer stage to produce a signal be-

CHAPTER 4

THEORY

Section I. THEORY OF RADIO RECEIVER R-392/URR

50. Principles of Operation
(figs. 89 and 90)

a. Radio Receiver R-392/URR is designed to furnish dependable, stable operation in vehicular service. It provides reception of voice (am.), tone-modulated radiotelegraph (mcw), unmodulated radiotelegraph (cw), and frequency-shift, single-channel radioteletype signals within a frequency range of .5 (500 kc) to 32 mc. This range is covered in 32 bands of 1 mc each, with the exception of the first band (.5 to 1 mc) which covers 500 kc.

b. The receiver is essentially a superheterodyne of the multiple-conversion type. Triple conversion is employed for the eight lowest bands (500 kc to 8 mc) and double conversion for the higher-frequency bands (8 to 32 mc). If. selectivity (bandwidth) can be varied to adapt the receiver to different conditions of reception by choosing one of three bandwidths.

c. A mechanically-driven tuning system is provided to achieve linear permeability tuning throughout the complete frequency range of the receiver. An internal crystal-controlled oscillator stage supplies a calibration signal which permits audible check of calibration of the counter-type frequency indicator to an accuracy of plus or minus 300 cycles.

d. The rf and if. gain are controlled either manually, by the RF GAIN SQUELCH THRESH control, or automatically, through two individual agc circuits.

e. Two outputs are available, either singly or simultaneously, at the front panel; a 200-mw audio-frequency output for use with a 600-ohm impedance headset or loudspeaker, and a 455-kc if. amplifier signal for operating a 50-ohm impedance frequency-shift, single-channel radioteletype converter.

f. An input voltage of 28 volts, dc, provides optimum results, although normal operation is maintained when the input voltage is between 25 and 30 volts, dc. *Operation is maintained at reduced gain at input voltages of between 22 and 25 volts, dc.* B+ and filament voltages of 28 volts, dc, are used for operation of all tubes and a crystal-oven heater.

Note. The output voltage from a 24-volt d-c vehicular electrical system is approximately 28 volts, dc, when the vehicle engine is running and the dc battery charging generator is in the electrical circuit. The current source for the electrical system is the battery when the engine is stopped and the battery charging generator when the engine is running.

51. Block Diagram
(fig. 24)

a. The block diagram shows the signal path from the antenna through the various stages to the output. A schematic diagram (figs. 89 and 90) shows details of the circuits in the same order.

b. Radio Receiver R-392/URR does not have a power supply but derives power from a 24-volt dc vehicular electrical system (or some similar electrical supply) or from an associated transmitter such as Radio Transmitter T-195/GRC-19.

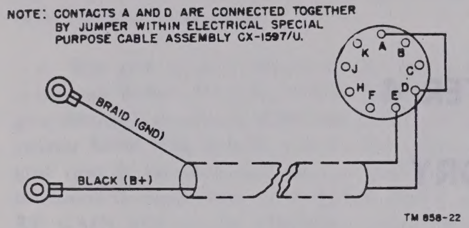

NOTE: CONTACTS A AND D ARE CONNECTED TOGETHER BY JUMPER WITHIN ELECTRICAL SPECIAL PURPOSE CABLE ASSEMBLY CX-1597/U.
K
A
B
J
C
H
F
E
D
BRAID (GND)
BLACK (B+)
TM 858-22

Figure 24. Electrical Special Purpose Cable Assembly CX-1597/U, wiring diagram.

49. Checking Battery Voltage

a. Weak output from the receiver, or no output, can be caused by low battery voltage. Under mobile operating conditions in a vehicle, the receiver drain on the vehicular batteries is not excessive. However, if the receiver is operated for long periods in a parked vehicle, the battery voltage will be reduced below that required for receiver operation. In order to assure sufficient voltage for operation of the receiver, the battery voltage must be checked at frequent intervals with the receiver turned on. Multimeter TS-297/U can be used for this purpose. The engine should be started and allowed to run at frequent intervals so that the battery can recharge. The receiver will operate on input voltages of 25 to 30 volts, dc; it will operate at reduced gain at input voltages between 22 and 25 volts, dc. The current source for the electrical system is the battery when the engine is stopped; and the battery-charging dc generator when the engine is running.

46. Equipment Performance Check List (cont)

	Item No.	Item	Action or condition	Normal indications	Corrective measures
S T O P	21	Function switch	Turn to STANDBY. Turn to OFF.	Receiver is silent. Dial lamps remain lighted. Dial lamps not lighted.	Refer to par. 96.

47. Checking Cam Synchronization

When the receiver is tuned through its range and a weak signal or no signal is heard, it is possible that the collar securing one of the camshafts on the rf subchassis (fig. 79) to its drive gear has become loose, allowing the shaft to slip out of synchronization with the rest of the mechanical tuning system. To determine whether this condition exists, withdraw the receiver from the case, set the frequency indicator to each of the readings listed in the first column of the chart below, in turn, and check to see that the cam or cams (fig. 80) indicated in the opposite columns are in the positions where the associated slug-rack or can-rack roller (fig. 78) is almost at the top of its rise. A slight deviation in position does not necessarily indicate that the cam is out of synchronization. If the deviation is large, however, a process of synchronization is necessary, and the receiver should be turned over to a qualified repairman. (See par. 113 *b*.)

Freq-indicator reading			Cam (figs. 78 and 80)								
Mc	±	Kc	1-2 mc	.5-1 mc	2-4 mc	4-8 mc	8-16 mc	16-32 mc	1st variable if. slug rack	1st variable if. can rack	2d variable if. slug rack
Any	−	075								Top	Top
Any	+	025	Top	Top							
03	+	025			Top						
07		Any							Top		
07	+	025				Top			Top		
15	+	025					Top				
31	+	025						Top			

48. Checking Power-cable Continuity

When the receiver is completely inoperative or when operation is intermittent, Electrical Special Purpose Cable Assembly CX-1597/U should be disconnected from the receiver and from the vehicular voltage system, and the power-cable continuity checked. Use Multimeter TS-297/U on the lowest ohmmeter range. A meter indication of less than ½ ohm should be obtained between the following: terminals A & D (fig. 24) of the plug and the solder lug attached to the black lead; terminal E of the plug and the braided (ground) lead. Check between terminals A and E of the plug, using the highest ohmmeter range; obtain a meter reading of an open circuit (∞).

46. Equipment Performance Check List (cont)

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE	11	KILOCYCLES control	Set MEGACYCLES control at any desired band. Tune through band by rotating KILOCYCLES control.	Signals heard in headphones.	If signals are weak or if none are heard, adjust (turn) ANT TRIM control and check connection at ANT connector. Check synchronization of cams (par. 47). Check tubes in receiver.
	12	ANT TRIM control (AGC switch at CAL)	Adjust for maximum signal strength.	Signal strength and indication on CARRIER LEVEL meter vary as control is adjusted.	Refer to par. 97.
	13	MEGACYCLES control	Check each band, using procedure given in item 11 above.	Signals heard on each band.	Refer to par. 97.
	14	RF GAIN SQUELCH THRESH control	Tune in station; then rotate gain control in one direction, then in the other.	Strength of signal increases and decreases.	Refer to par. 97.
	15	AF GAIN control	Rotate control in one direction, then in the other.	Strength of signal increases and decreases.	Refer to par. 97.
	16	Function switch	Turn to NOISE LIM.	When static is present, noise peaks are reduced in amplitude.	Check V603. Refer to par. 97.
			Turn to SQ. Tune in several stations, in turn.	No noise heard between stations.	Check V602, V605, and V609. Refer to Chapter 5.
	17	AGC switch	With AGC switch set to ON, tune to station giving strong indication on CARRIER LEVEL meter. Turn AGC switch to OFF.	Indication on CARRIER LEVEL meter decreases to a zero reading when switch is turned to OFF.	Check V601, V602, and V609. Refer to par. 97.
			Turn to CAL and vary KILOCYCLES control over its complete range.	Calibration signal heard every 100 kc throughout band.	Check V701, V702, and V703. Refer to par. 97.
	18	BFO switch	Turn to ON and tune in cw carrier or set AGC switch to CAL.	Beat-frequency audio signal heard in headphones.	Check V604. Refer to par. 97.
	19	BFO PITCH control	Rotate control on either side of O. Turn BFO switch to OFF after test.	Change in pitch of audio tone is noted.	Refer to par. 97.
	20	BAND WIDTH switch	Tune receiver to a modulated signal, then change BAND WIDTH switch 8 to 2.	Selectivity becomes sharper and noise decreases as bandwidth is decreased. Only low-frequency audio tones heard when switch is at 2KC position.	Refer to par. 97.

c. Normal Indications. The normal indications listed include the visible and audible signs that the repairman should perceive when he checks the items. If the indications are normal, the repairman should apply the recommended corrective measures.

d. Corrective Measures. The corrective measures listed are those that the repairman can take without turning in the equipment for repairs. A reference in the table to a paragraph indicates that the trouble cannot be corrected during operation, and that trouble shooting by an experienced repairman is necessary. If the receiver is completely inoperative, or if the recommended corrective measures do not yield results, trouble shooting at a higher echelon of maintenance is necessary. However, if the tactical situation requires that communication be maintained, and if the receiver is not completely inoperative, the operator must maintain the receiver in operation as long as it is possible to do so.

46. Equipment Performance Check List

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	Antenna	Lead in cable connected to ANT binding post.		
	2	Headset	Connected to either of the two AUDIO receptacles.		
	3	Electrical Special Purpose Cable Assembly CX-1597/U	Connected between POWER INPUT-TRANS CONT receptacle and vehicular battery (par. 18 b).		
	4	BAND WIDTH switch	Set at 4KC or 8.		
	5	RF GAIN SQUELCH THRESH control	Set at full-clockwise position.		
	6	AF GAIN control	Set at midposition		
	7	AGC switch	Set at ON		
	8	BFO switch	Set at OFF.		
	9	DIAL DIM switch	Set at ON.		
START	10	Function switch	Turn to NORMAL.	Dial lamps light.	Check fuses and dial lamps I201 and I202. The ten screws securing the frequency indicator dial window (on the front panel) must be removed in order to replace or check dial lamps. Check power cable (par. 48). Check seating of P106 in J206. Check vehicular battery (par. 49)
				Rushing sounds heard in headphones.	Check tubes and connectors between subchassis. Check voltage of vehicular battery (par. 49).

held in place by a special clamp. *Make sure that corrugated metal insert is in place when replacing vfo tube shield.*

(3) Use proper tube puller and extract tubes carefully to avoid bending pins or spreading socket contacts. Avoid excessive moving of tube from side to side during extraction, because miniature tube pins are easily bent.

b. Checking Tubes by Substitution in a Similar Receiver. Tune a similar receiver which is in good operating condition to a voice signal that is not subject to fading. Turn the AGC switch to ON, the function switch to NORMAL, and the RF GAIN SQUELCH THRESH control fully clockwise. Make the substitutions from the faulty receiver to a corresponding position in the good receiver, one tube at a time. Tap the tube under test; if noise or abnormal change in volume is observed, replace the tube. Usually a considerable decrease in indication on the CARRIER LEVEL meter or a noticeable decrease in volume or quality of the signal emitted from the speaker or head set indicates a weak or defective tube (for tubes in those stages up to and including the second if. amplifier). However, different test results for the following tubes must be observed.

(1) The condition of tubes V606, V607, and V608 on the audio subchassis does not ordinarily change the indication of the CARRIER LEVEL meter, but volume and quality of signal are to be noted carefully. When tube V609 (agc if. amplifier) is weak, an *increase* in volume and decrease in indication on CARRIER LEVEL meter will result.

(2) If tube V601 (if. cathode follower) is weak, the signal from the IF OUT receptacle will be weak (indicated by abnormal operation of single-channel converter connected to receptacle); if a very strong signal is being received, the receiver may block and prevent passage of the signal to IF OUT receptacle. If tube V602 (rf and if. agc rectifier) is weak or defective, an increase in volume or a lower indication on the CARRIER LEVEL meter will result.

(3) A change in volume or quality of the output signal will result if V603A (detector) is defective. To test the noise limiter V603B, tune the receiver slightly away from the test signal so that the noisy signal is received, and then turn the function switch to NOISE LIM. The tube under test and a tube that is known to be good should be equally effective in reducing noise. To check V605 (squelch control), rotate the function switch to SQ, and tune the receiver from one station to another. As the receiver is tuned between stations, it should be silenced. Return the function switch to NORMAL, and retune the receiver to the test signal.

(4) When checking V604 (bfo), turn the BFO switch to ON, vary the BFO PITCH control, and listen for a varying beat note.

(5) To test V701, V702, and V703 (calibration-oscillator circuit), turn the AGC switch to CAL, and tune through a minimum of eleven 100-kc calibration check points in the .5 to 32-mc bands. A peak should be observed on the CARRIER LEVEL meter at each 100-kc point. At the 100-kc points the last two digits on the frequency indicator dial should be 00.

c. Checking Tubes by Substituting Spares. Replace the tubes in the faulty receiver, one at a time, with the spare tubes, following the same general procedure outlined in subparagraph *b* above.

45. Trouble Shooting by Using Equipment Performance Check List

a. General. The equipment performance check list (par. 46) is a further aid to the repairman in locating trouble in the equipment when visual inspection has failed to disclose the cause. The list gives the item to be checked, the conditions under which the item is checked, the normal indications and tolerances of correct operation, and the corrective measures to be taken. *To use this list, follow the items in numerical sequence.*

b. Action or Condition. For some items, the information given in the *Action or condition* column consists of various switch and control settings with which the item is to be checked. For other items, an action is given that must be taken to check the normal indication given in the *Normal indications* column.

modulated radiotelegraph, and unmodulated radiotelegraph operation (pars. 23 and 24), in turn.

(6) Clean the exterior of the case, mounting, AUDIO and POWER INPUT-TRANS CONT receptacles, and the antenna base. Use a clean, lint-free cloth. Remove grease, if necessary, with a cloth dampened in solvent (SD). Wipe dry. Inspect the power cable and connectors.

(7) Inspect the case, mounting, and whip antenna for rust, corrosion, and moisture. Remove all rust spots from mounting and antenna base with #0000 sandpaper and touch up bare spots (par. 35).

(8) Inspect the antenna lead-in cable, power cable assembly, headset cord, and shock mounts for cuts, breaks, fraying, deterioration, kinks, and strain. Repair cuts in insulation, and fraying, with rubber tape, followed by electrician's tape. Replace broken cables, if possible, or have them repaired.

(9) Inspect the antenna for bends, corrosion, loose fit, and cracked or broken insulator. Straighten a bent antenna if possible: otherwise, it should be replaced. Touch up where necessary. Tighten the antenna. Replace any cracked or broken ceramic insulator.

(10) Check for looseness of the front-panel control knobs. Tighten with the Bristo wrench provided. Check the tightness of the ten captive thumbscrews. See that the receiver is secured firmly to the mounting by the two clamps on the front of the mounting. See that the cap is tightened on the IF OUT receptacle, if not in use. See that all cable plugs are secure in their receptacles.

(11) Inspect the vehicular storage batteries for dirt and corrosion on terminals, loose terminals, proper electrolyte level and specific gravity, and damaged cases.

(12) Using a clean, damp cloth, clean the glass windows of the CARRIER LEVEL meter and frequency indicator dial. Wipe dry. Clean the name plate.

(13) Inspect the CARRIER LEVEL meter and the frequency indicator for cracked or broken glass windows.

(14) Inspect the LINE fuse, PLATE fuse, and fuse holders for corrosion, cracks, and lack of sufficient tension to insure good contact.

b. Interior Preventive Maintenance. To perform interior preventive maintenance, proceed as follows:

(1) Remove the tubes from their sockets, one at a time, and inspect for loose envelopes and cracked sockets. Remove dust and dirt from the tube envelopes. Check the tubes for emission and short-circuited electrodes; use tube tester such as Electron Tube Test Set TV-7/U. Straighten tube pins with a pin straightener. Replace the tubes carefully; check for adequate spring tension in the individual pin sockets. See that all tubes are firmly seated in their sockets in an upright position. Be sure that corrugated metal inserts, where used, are replaced in the tube shields, and that the shields are replaced correctly and tightened down so that movement is not possible.

(2) Inspect relays K101 and K601 for loose mounting; burned, pitted or corroded contacts; misalignment of contacts and springs, and insufficient spring tension.

(3) Inspect variable capacitors for dirt, moisture, misalignment of plates, and loose mounting.

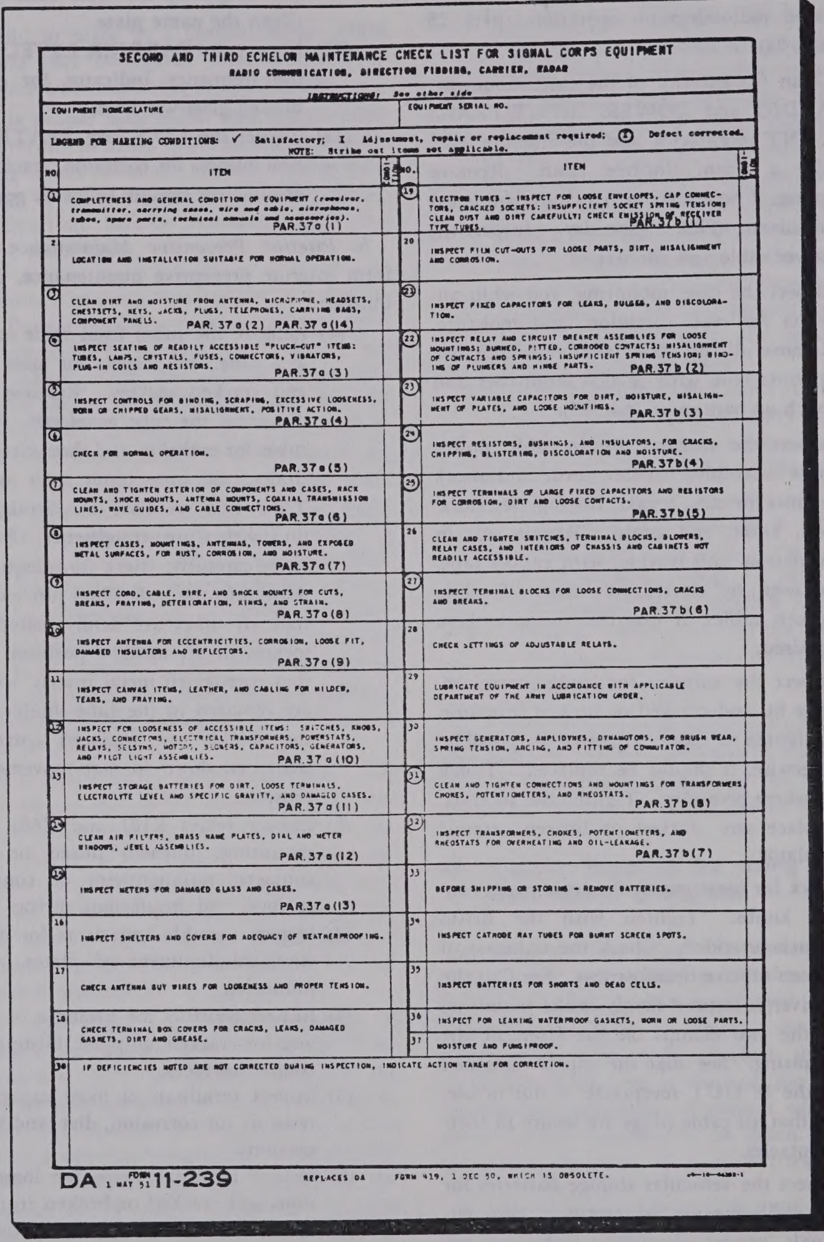
(4) Inspect resistors for presence of moisture, and for cracked, chipped, blistered, or discolored surfaces.

(5) Inspect terminals of fixed capacitors and resistors for corrosion, dirt, and loose connections.

(6) Inspect terminal strips for loose connections and cracked or broken insulation.

(7) Inspect connections and mountings of transformers, chokes, and potentiometers to see that they are clean and secure.

(8) Inspect all connectors to see that they are clean and securely connected.



SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE

EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; ⓧ Defect corrected.

NOTE: Strike out items not applicable.

NO	ITEM	CONDITION	NO.	ITEM	CONDITION
①	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (*receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories*). PAR.37a (1)		⑲	ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS: INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES. PAR.37b (1)	
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.		20	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.	
③	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 37a (2) PAR.37a (14)		㉑	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION.	
④	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR.37a (3)		㉒	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS. PAR.37b (2)	
⑤	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR.37a (4)		㉓	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS. PAR.37b (3)	
⑥	CHECK FOR NORMAL OPERATION. PAR.37a (5)		㉔	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. PAR.37b (4)	
⑦	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR.37a (6)		㉕	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. PAR.37b (5)	
⑧	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR.37a (7)		26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE.	
⑨	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR.37a (8)		㉗	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS. PAR.37b (6)	
⑩	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. PAR.37a (9)		28	CHECK SETTINGS OF ADJUSTABLE RELAYS.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.		29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.	
⑫	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR.37a (10)		30	INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.	
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES. PAR.37a (11)		㉛	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS. PAR.37b (8)	
⑭	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR.37a (12)		㉜	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE. PAR.37b (7)	
⑮	INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR.37a (13)		33	BEFORE SHIPPING OR STORING - REMOVE BATTERIES.	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.		34	INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.		35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.	
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.		36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.	
			37	MOISTURE AND FUNGIPROOF.	
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.				

DA FORM 1 MAY 51 11-239 REPLACES DA FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM 858-19

Figure 21. DA Form 11-239.

modulated radiotelegraph, and unmodulated radiotelegraph operation (pars. 23 and 24), in turn.

(6) Clean the exterior of the case, mounting, AUDIO and POWER INPUT-TRANS CONT receptacles, and the antenna base. Use a clean, lint-free cloth. Remove grease, if necessary, with a cloth dampened in solvent (SD). Wipe dry. Inspect the power cable and connectors.

(7) Inspect the case, mounting, and whip antenna for rust, corrosion, and moisture. Remove all rust spots from mounting and antenna base with #0000 sandpaper and touch up bare spots (par. 35).

(8) Inspect the antenna lead-in cable, power cable assembly, headset cord, and shock mounts for cuts, breaks, fraying, deterioration, kinks, and strain. Repair cuts in insulation, and fraying, with rubber tape, followed by electrician's tape. Replace broken cables, if possible, or have them repaired.

(9) Inspect the antenna for bends, corrosion, loose fit, and cracked or broken insulator. Straighten a bent antenna if possible; otherwise, it should be replaced. Touch up where necessary. Tighten the antenna. Replace any cracked or broken ceramic insulator.

(10) Check for looseness of the front-panel control knobs. Tighten with the Bristo wrench provided. Check the tightness of the ten captive thumbscrews. See that the receiver is secured firmly to the mounting by the two clamps on the front of the mounting. See that the cap is tightened on the IF OUT receptacle, if not in use. See that all cable plugs are secure in their receptacles.

(11) Inspect the vehicular storage batteries for dirt and corrosion on terminals, loose terminals, proper electrolyte level and specific gravity, and damaged cases.

(12) Using a clean, damp cloth, clean the glass windows of the CARRIER LEVEL meter and frequency indicator dial. Wipe dry. Clean the name plate.

(13) Inspect the CARRIER LEVEL meter and the frequency indicator for cracked or broken glass windows.

(14) Inspect the LINE fuse, PLATE fuse, and fuse holders for corrosion, cracks, and lack of sufficient tension to insure good contact.

b. Interior Preventive Maintenance. To perform interior preventive maintenance, proceed as follows:

(1) Remove the tubes from their sockets, one at a time, and inspect for loose envelopes and cracked sockets. Remove dust and dirt from the tube envelopes. Check the tubes for emission and short-circuited electrodes; use tube tester such as Electron Tube Test Set TV-7/U. Straighten tube pins with a pin straightener. Replace the tubes carefully; check for adequate spring tension in the individual pin sockets. See that all tubes are firmly seated in their sockets in an upright position. Be sure that corrugated metal inserts, where used, are replaced in the tube shields, and that the shields are replaced correctly and tightened down so that movement is not possible.

(2) Inspect relays K101 and K601 for loose mounting; burned, pitted or corroded contacts; misalignment of contacts and springs, and insufficient spring tension.

(3) Inspect variable capacitors for dirt, moisture, misalignment of plates, and loose mounting.

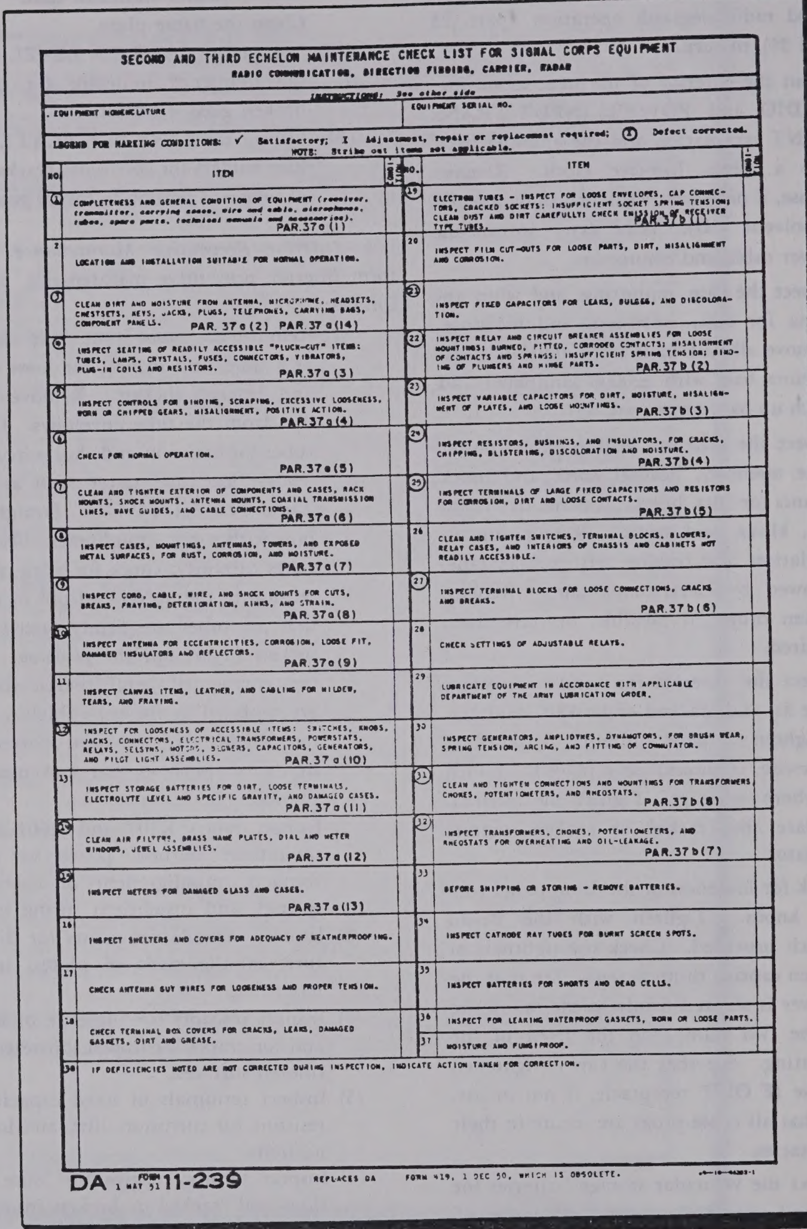
(4) Inspect resistors for presence of moisture, and for cracked, chipped, blistered, or discolored surfaces.

(5) Inspect terminals of fixed capacitors and resistors for corrosion, dirt, and loose connections.

(6) Inspect terminal strips for loose connections and cracked or broken insulation.

(7) Inspect connections and mountings of transformers, chokes, and potentiometers to see that they are clean and secure.

(8) Inspect all connectors to see that they are clean and securely connected.



SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE

EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; ⓧ Defect corrected.

NOTE: Strike out items not applicable.

NO.	ITEM	CONDI-TION	NO.	ITEM	CONDI-TION
①	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories). PAR.37a (1)		⑲	ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS: INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES. PAR.37b (1)	
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.		20	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.	
③	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 37a (2) PAR. 37a (14)		㉑	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION.	
④	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR.37a (3)		㉒	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS. PAR.37b (2)	
⑤	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR.37a (4)		㉓	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS. PAR.37b (3)	
⑥	CHECK FOR NORMAL OPERATION. PAR.37a (5)		㉔	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. PAR.37b (4)	
⑦	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR.37a (6)		㉕	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. PAR.37b (5)	
⑧	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR.37a (7)		26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE.	
⑨	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 37a (8)		㉗	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS. PAR.37b (6)	
⑩	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. PAR. 37a (9)		28	CHECK SETTINGS OF ADJUSTABLE RELAYS.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.		29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.	
⑫	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR. 37a (10)		30	INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.	
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES. PAR. 37a (11)		㉛	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS. PAR.37b (8)	
⑭	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 37a (12)		㉜	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE. PAR.37b (7)	
⑮	INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR.37a (13)		33	BEFORE SHIPPING OR STORING - REMOVE BATTERIES.	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.		34	INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.		35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.	
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.		36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.	
			37	MOISTURE AND FUNGIPROOF.	
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.				

DA FORM 1 MAY 51 11-239 REPLACES DA FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM 858-19

Figure 21. DA Form 11-239.

modulated radiotelegraph, and unmodulated radiotelegraph operation (pars. 23 and 24), in turn.

(6) Clean the exterior of the case, mounting, AUDIO and POWER INPUT-TRANS CONT receptacles, and the antenna base. Use a clean, lint-free cloth. Remove grease, if necessary, with a cloth dampened in solvent (SD). Wipe dry. Inspect the power cable and connectors.

(7) Inspect the case, mounting, and whip antenna for rust, corrosion, and moisture. Remove all rust spots from mounting and antenna base with #0000 sandpaper and touch up bare spots (par. 35).

(8) Inspect the antenna lead-in cable, power cable assembly, headset cord, and shock mounts for cuts, breaks, fraying, deterioration, kinks, and strain. Repair cuts in insulation, and fraying, with rubber tape, followed by electrician's tape. Replace broken cables, if possible, or have them repaired.

(9) Inspect the antenna for bends, corrosion, loose fit, and cracked or broken insulator. Straighten a bent antenna if possible: otherwise, it should be replaced. Touch up where necessary. Tighten the antenna. Replace any cracked or broken ceramic insulator.

(10) Check for looseness of the front-panel control knobs. Tighten with the Bristo wrench provided. Check the tightness of the ten captive thumbscrews. See that the receiver is secured firmly to the mounting by the two clamps on the front of the mounting. See that the cap is tightened on the IF OUT receptacle, if not in use. See that all cable plugs are secure in their receptacles.

(11) Inspect the vehicular storage batteries for dirt and corrosion on terminals, loose terminals, proper electrolyte level and specific gravity, and damaged cases.

(12) Using a clean, damp cloth, clean the glass windows of the CARRIER LEVEL meter and frequency indicator dial. Wipe dry. Clean the name plate.

(13) Inspect the CARRIER LEVEL meter and the frequency indicator for cracked or broken glass windows.

(14) Inspect the LINE fuse, PLATE fuse, and fuse holders for corrosion, cracks, and lack of sufficient tension to insure good contact.

b. Interior Preventive Maintenance. To perform interior preventive maintenance, proceed as follows:

(1) Remove the tubes from their sockets, one at a time, and inspect for loose envelopes and cracked sockets. Remove dust and dirt from the tube envelopes. Check the tubes for emission and short-circuited electrodes; use tube tester such as Electron Tube Test Set TV-7/U. Straighten tube pins with a pin straightener. Replace the tubes carefully; check for adequate spring tension in the individual pin sockets. See that all tubes are firmly seated in their sockets in an upright position. Be sure that corrugated metal inserts, where used, are replaced in the tube shields, and that the shields are replaced correctly and tightened down so that movement is not possible.

(2) Inspect relays K101 and K601 for loose mounting; burned, pitted or corroded contacts; misalignment of contacts and springs, and insufficient spring tension.

(3) Inspect variable capacitors for dirt, moisture, misalignment of plates, and loose mounting.

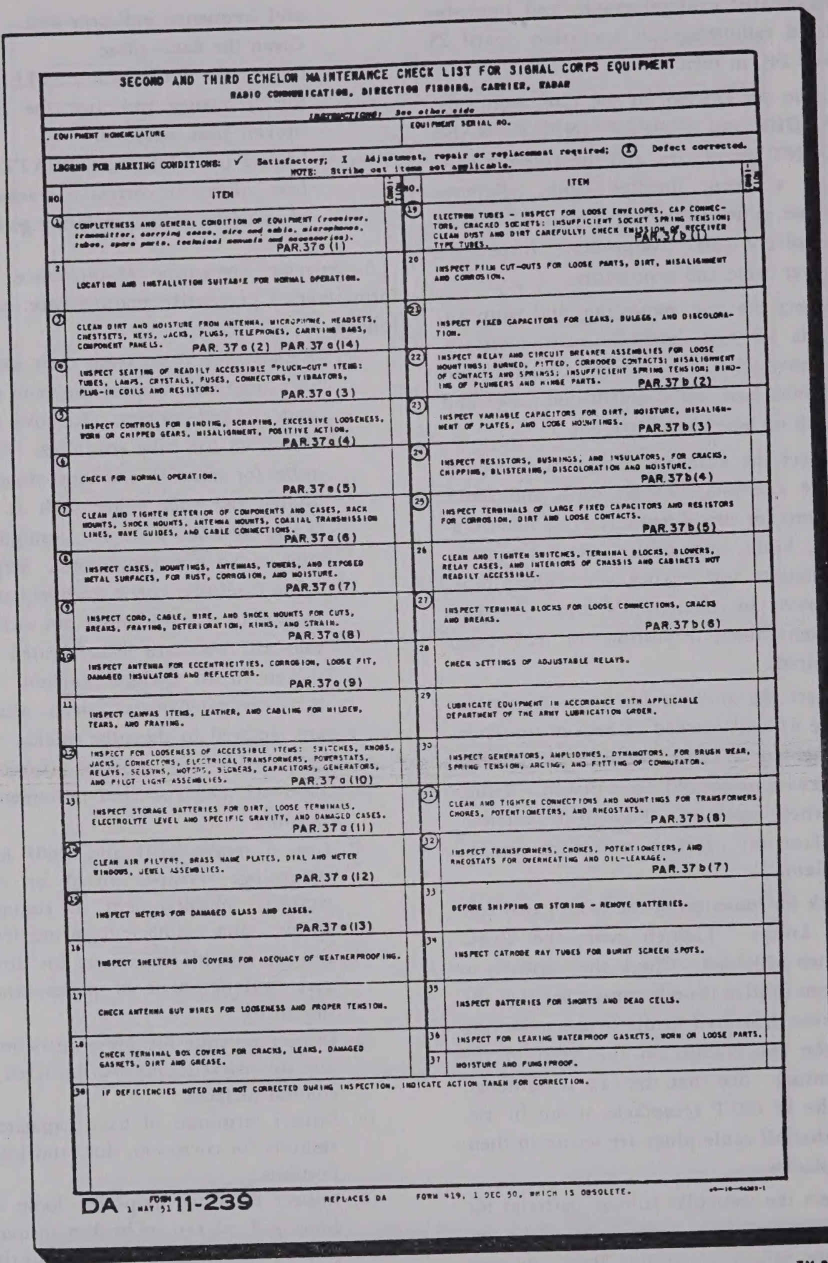
(4) Inspect resistors for presence of moisture, and for cracked, chipped, blistered, or discolored surfaces.

(5) Inspect terminals of fixed capacitors and resistors for corrosion, dirt, and loose connections.

(6) Inspect terminal strips for loose connections and cracked or broken insulation.

(7) Inspect connections and mountings of transformers, chokes, and potentiometers to see that they are clean and secure.

(8) Inspect all connectors to see that they are clean and securely connected.



SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT
RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE

EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; Ⓧ Defect corrected.
NOTE: Strike out items not applicable.

NO	ITEM	CONDITION	NO.	ITEM	CONDITION
①	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories). PAR.37a(1)		⑲	ELECTRON TUBES – INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS; INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES. PAR.37b(1)	
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.		20	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.	
③	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 37a(2) PAR.37a(14)		㉑	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION.	
④	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR.37a(3)		㉒	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS. PAR.37b(2)	
⑤	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR.37a(4)		㉓	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS. PAR.37b(3)	
⑥	CHECK FOR NORMAL OPERATION. PAR.37a(5)		㉔	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. PAR.37b(4)	
⑦	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR.37a(6)		㉕	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. PAR.37b(5)	
⑧	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR.37a(7)		26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE.	
⑨	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR.37a(8)		㉗	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS. PAR.37b(6)	
⑩	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. PAR.37a(9)		28	CHECK SETTINGS OF ADJUSTABLE RELAYS.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.		29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.	
⑫	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR.37a(10)		30	INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.	
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES. PAR.37a(11)		㉛	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS. PAR.37b(8)	
⑭	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR.37a(12)		㉜	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE. PAR.37b(7)	
⑮	INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR.37a(13)		33	BEFORE SHIPPING OR STORING – REMOVE BATTERIES.	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.		34	INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.		35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.	
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.		36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.	
			37	MOISTURE AND FUNGIPROOF.	
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.				

DA FORM 1 MAY 51 11-239 REPLACES DA FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM 856-19

Figure 21. DA Form 11-239.

modulated radiotelegraph, and unmodulated radiotelegraph operation (pars. 23 and 24), in turn.

(6) Clean the exterior of the case, mounting, AUDIO and POWER INPUT-TRANS CONT receptacles, and the antenna base. Use a clean, lint-free cloth. Remove grease, if necessary, with a cloth dampened in solvent (SD). Wipe dry. Inspect the power cable and connectors.

(7) Inspect the case, mounting, and whip antenna for rust, corrosion, and moisture. Remove all rust spots from mounting and antenna base with #0000 sandpaper and touch up bare spots (par. 35).

(8) Inspect the antenna lead-in cable, power cable assembly, headset cord, and shock mounts for cuts, breaks, fraying, deterioration, kinks, and strain. Repair cuts in insulation, and fraying, with rubber tape, followed by electrician's tape. Replace broken cables, if possible, or have them repaired.

(9) Inspect the antenna for bends, corrosion, loose fit, and cracked or broken insulator. Straighten a bent antenna if possible; otherwise, it should be replaced. Touch up where necessary. Tighten the antenna. Replace any cracked or broken ceramic insulator.

(10) Check for looseness of the front-panel control knobs. Tighten with the Bristo wrench provided. Check the tightness of the ten captive thumbscrews. See that the receiver is secured firmly to the mounting by the two clamps on the front of the mounting. See that the cap is tightened on the IF OUT receptacle, if not in use. See that all cable plugs are secure in their receptacles.

(11) Inspect the vehicular storage batteries for dirt and corrosion on terminals, loose terminals, proper electrolyte level and specific gravity, and damaged cases.

(12) Using a clean, damp cloth, clean the glass windows of the CARRIER LEVEL meter and frequency indicator dial. Wipe dry. Clean the name plate.

(13) Inspect the CARRIER LEVEL meter and the frequency indicator for cracked or broken glass windows.

(14) Inspect the LINE fuse, PLATE fuse, and fuse holders for corrosion, cracks, and lack of sufficient tension to insure good contact.

b. Interior Preventive Maintenance. To perform interior preventive maintenance, proceed as follows:

(1) Remove the tubes from their sockets, one at a time, and inspect for loose envelopes and cracked sockets. Remove dust and dirt from the tube envelopes. Check the tubes for emission and short-circuited electrodes; use tube tester such as Electron Tube Test Set TV-7/U. Straighten tube pins with a pin straightener. Replace the tubes carefully; check for adequate spring tension in the individual pin sockets. See that all tubes are firmly seated in their sockets in an upright position. Be sure that corrugated metal inserts, where used, are replaced in the tube shields, and that the shields are replaced correctly and tightened down so that movement is not possible.

(2) Inspect relays K101 and K601 for loose mounting; burned, pitted or corroded contacts; misalignment of contacts and springs, and insufficient spring tension.

(3) Inspect variable capacitors for dirt, moisture, misalignment of plates, and loose mounting.

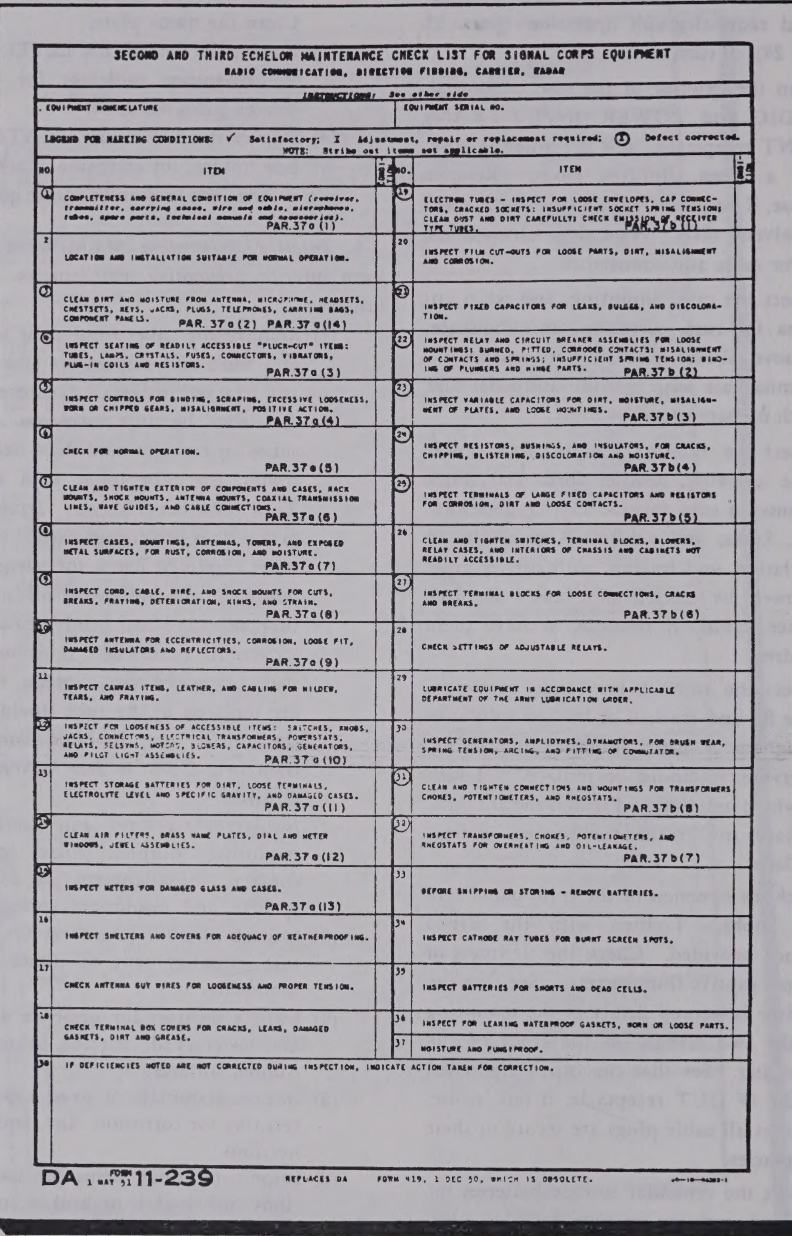
(4) Inspect resistors for presence of moisture, and for cracked, chipped, blistered, or discolored surfaces.

(5) Inspect terminals of fixed capacitors and resistors for corrosion, dirt, and loose connections.

(6) Inspect terminal strips for loose connections and cracked or broken insulation.

(7) Inspect connections and mountings of transformers, chokes, and potentiometers to see that they are clean and secure.

(8) Inspect all connectors to see that they are clean and securely connected.



SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE

EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; ① Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	[illegible]	NO.	ITEM	[illegible]
①	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (*receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories*). PAR.37a(1)		⑲	ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS: INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES. PAR.37b(1)	
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.		20	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.	
③	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 37a(2) PAR.37a(14)		㉑	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION.	
④	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR.37a(3)		㉒	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS. PAR.37b(2)	
⑤	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR.37a(4)		㉓	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS. PAR.37b(3)	
⑥	CHECK FOR NORMAL OPERATION. PAR.37a(5)		㉔	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. PAR.37b(4)	
⑦	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR.37a(6)		㉕	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. PAR.37b(5)	
⑧	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR.37a(7)		26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE.	
⑨	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 37a(8)		㉗	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS. PAR.37b(6)	
⑩	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. PAR.37a(9)		28	CHECK SETTINGS OF ADJUSTABLE RELAYS.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.		29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.	
⑫	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR.37a(10)		30	INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.	
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES. PAR. 37a(11)		㉛	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS. PAR.37b(8)	
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⑮	INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR.37a(13)		33	BEFORE SHIPPING OR STORING - REMOVE BATTERIES.	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.		34	INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.		35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.	
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.		36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.	
			37	MOISTURE AND FUNGIPROOF.	
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.				

DA FORM 1 MAY 51 11-239 REPLACES DA FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM 856-19

Figure 21. DA Form 11-239.

modulated radiotelegraph, and unmodulated radiotelegraph operation (pars. 23 and 24), in turn.

(6) Clean the exterior of the case, mounting, AUDIO and POWER INPUT-TRANS CONT receptacles, and the antenna base. Use a clean, lint-free cloth. Remove grease, if necessary, with a cloth dampened in solvent (SD). Wipe dry. Inspect the power cable and connectors.

(7) Inspect the case, mounting, and whip antenna for rust, corrosion, and moisture. Remove all rust spots from mounting and antenna base with #0000 sandpaper and touch up bare spots (par. 35).

(8) Inspect the antenna lead-in cable, power cable assembly, headset cord, and shock mounts for cuts, breaks, fraying, deterioration, kinks, and strain. Repair cuts in insulation, and fraying, with rubber tape, followed by electrician's tape. Replace broken cables, if possible, or have them repaired.

(9) Inspect the antenna for bends, corrosion, loose fit, and cracked or broken insulator. Straighten a bent antenna if possible; otherwise, it should be replaced. Touch up where necessary. Tighten the antenna. Replace any cracked or broken ceramic insulator.

(10) Check for looseness of the front-panel control knobs. Tighten with the Bristo wrench provided. Check the tightness of the ten captive thumbscrews. See that the receiver is secured firmly to the mounting by the two clamps on the front of the mounting. See that the cap is tightened on the IF OUT receptacle, if not in use. See that all cable plugs are secure in their receptacles.

(11) Inspect the vehicular storage batteries for dirt and corrosion on terminals, loose terminals, proper electrolyte level and specific gravity, and damaged cases.

(12) Using a clean, damp cloth, clean the glass windows of the CARRIER LEVEL meter and frequency indicator dial. Wipe dry. Clean the name plate.

(13) Inspect the CARRIER LEVEL meter and the frequency indicator for cracked or broken glass windows.

(14) Inspect the LINE fuse, PLATE fuse, and fuse holders for corrosion, cracks, and lack of sufficient tension to insure good contact.

b. Interior Preventive Maintenance. To perform interior preventive maintenance, proceed as follows:

(1) Remove the tubes from their sockets, one at a time, and inspect for loose envelopes and cracked sockets. Remove dust and dirt from the tube envelopes. Check the tubes for emission and short-circuited electrodes; use tube tester such as Electron Tube Test Set TV-7/U. Straighten tube pins with a pin straightener. Replace the tubes carefully; check for adequate spring tension in the individual pin sockets. See that all tubes are firmly seated in their sockets in an upright position. Be sure that corrugated metal inserts, where used, are replaced in the tube shields, and that the shields are replaced correctly and tightened down so that movement is not possible.

(2) Inspect relays K101 and K601 for loose mounting; burned, pitted or corroded contacts; misalignment of contacts and springs, and insufficient spring tension.

(3) Inspect variable capacitors for dirt, moisture, misalignment of plates, and loose mounting.

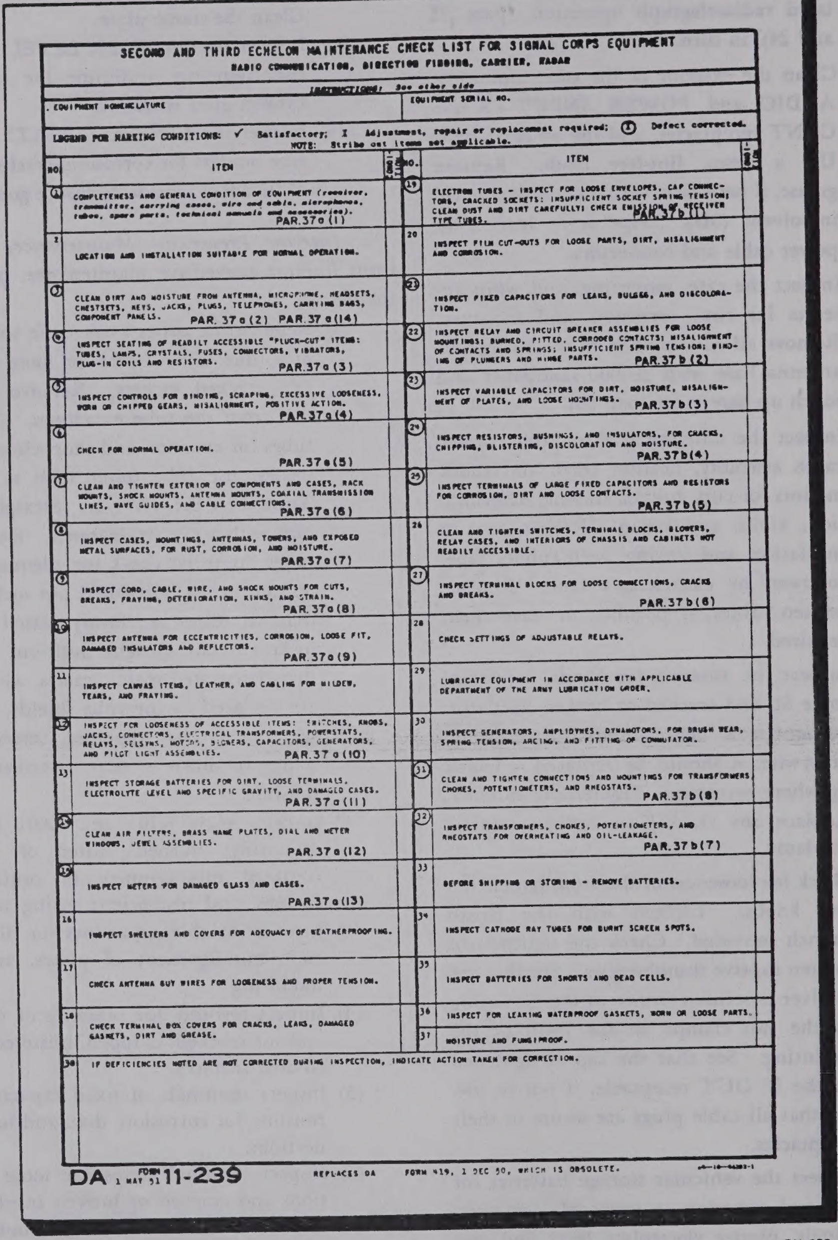
(4) Inspect resistors for presence of moisture, and for cracked, chipped, blistered, or discolored surfaces.

(5) Inspect terminals of fixed capacitors and resistors for corrosion, dirt, and loose connections.

(6) Inspect terminal strips for loose connections and cracked or broken insulation.

(7) Inspect connections and mountings of transformers, chokes, and potentiometers to see that they are clean and secure.

(8) Inspect all connectors to see that they are clean and securely connected.



SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT
RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

. EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; ① Defect corrected.
NOTE: Strike out items not applicable.

NO	ITEM	CONDI-TION	NO.	ITEM	CONDI-TION
①	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (*receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories*). PAR.37a (1)		⑲	ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS: INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES. PAR.37b (1)	
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.		20	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.	
③	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 37a (2) PAR. 37a (14)		㉑	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION.	
④	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR.37a (3)		㉒	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS. PAR.37b (2)	
⑤	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR.37a (4)		㉓	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS. PAR.37b (3)	
⑥	CHECK FOR NORMAL OPERATION. PAR.37a (5)		㉔	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. PAR.37b (4)	
⑦	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR.37a (6)		㉕	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. PAR.37b (5)	
⑧	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR.37a (7)		26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE.	
⑨	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 37a (8)		㉗	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS. PAR.37b (6)	
⑩	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. PAR.37a (9)		28	CHECK SETTINGS OF ADJUSTABLE RELAYS.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.		29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.	
⑫	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR.37a (10)		30	INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.	
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES. PAR. 37a (11)		㉛	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS CHOKES, POTENTIOMETERS, AND RHEOSTATS. PAR.37b (8)	
⑭	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 37a (12)		㉜	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE. PAR. 37b (7)	
⑮	INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR.37a (13)		33	BEFORE SHIPPING OR STORING - REMOVE BATTERIES.	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.		34	INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.		35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.	
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.		36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.	
			37	MOISTURE AND FUNGIPROOF.	
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.				

DA FORM 1 MAY 51 11-239 REPLACES DA FORM 419, 1 DEC 50, WHICH IS OBSOLETE. [illegible]

TM 856-19

Figure 21. DA Form 11-239.

modulated radiotelegraph, and unmodulated radiotelegraph operation (pars. 23 and 24), in turn.

(6) Clean the exterior of the case, mounting, AUDIO and POWER INPUT-TRANS CONT receptacles, and the antenna base. Use a clean, lint-free cloth. Remove grease, if necessary, with a cloth dampened in solvent (SD). Wipe dry. Inspect the power cable and connectors.

(7) Inspect the case, mounting, and whip antenna for rust, corrosion, and moisture. Remove all rust spots from mounting and antenna base with #0000 sandpaper and touch up bare spots (par. 35).

(8) Inspect the antenna lead-in cable, power cable assembly, headset cord, and shock mounts for cuts, breaks, fraying, deterioration, kinks, and strain. Repair cuts in insulation, and fraying, with rubber tape, followed by electrician's tape. Replace broken cables, if possible, or have them repaired.

(9) Inspect the antenna for bends, corrosion, loose fit, and cracked or broken insulator. Straighten a bent antenna if possible; otherwise, it should be replaced. Touch up where necessary. Tighten the antenna. Replace any cracked or broken ceramic insulator.

(10) Check for looseness of the front-panel control knobs. Tighten with the Bristo wrench provided. Check the tightness of the ten captive thumbscrews. See that the receiver is secured firmly to the mounting by the two clamps on the front of the mounting. See that the cap is tightened on the IF OUT receptacle, if not in use. See that all cable plugs are secure in their receptacles.

(11) Inspect the vehicular storage batteries for dirt and corrosion on terminals, loose terminals, proper electrolyte level and specific gravity, and damaged cases.

(12) Using a clean, damp cloth, clean the glass windows of the CARRIER LEVEL meter and frequency indicator dial. Wipe dry. Clean the name plate.

(13) Inspect the CARRIER LEVEL meter and the frequency indicator for cracked or broken glass windows.

(14) Inspect the LINE fuse, PLATE fuse, and fuse holders for corrosion, cracks, and lack of sufficient tension to insure good contact.

b. Interior Preventive Maintenance. To perform interior preventive maintenance, proceed as follows:

(1) Remove the tubes from their sockets, one at a time, and inspect for loose envelopes and cracked sockets. Remove dust and dirt from the tube envelopes. Check the tubes for emission and short-circuited electrodes; use tube tester such as Electron Tube Test Set TV-7/U. Straighten tube pins with a pin straightener. Replace the tubes carefully; check for adequate spring tension in the individual pin sockets. See that all tubes are firmly seated in their sockets in an upright position. Be sure that corrugated metal inserts, where used, are replaced in the tube shields, and that the shields are replaced correctly and tightened down so that movement is not possible.

(2) Inspect relays K101 and K601 for loose mounting; burned, pitted or corroded contacts; misalignment of contacts and springs, and insufficient spring tension.

(3) Inspect variable capacitors for dirt, moisture, misalignment of plates, and loose mounting.

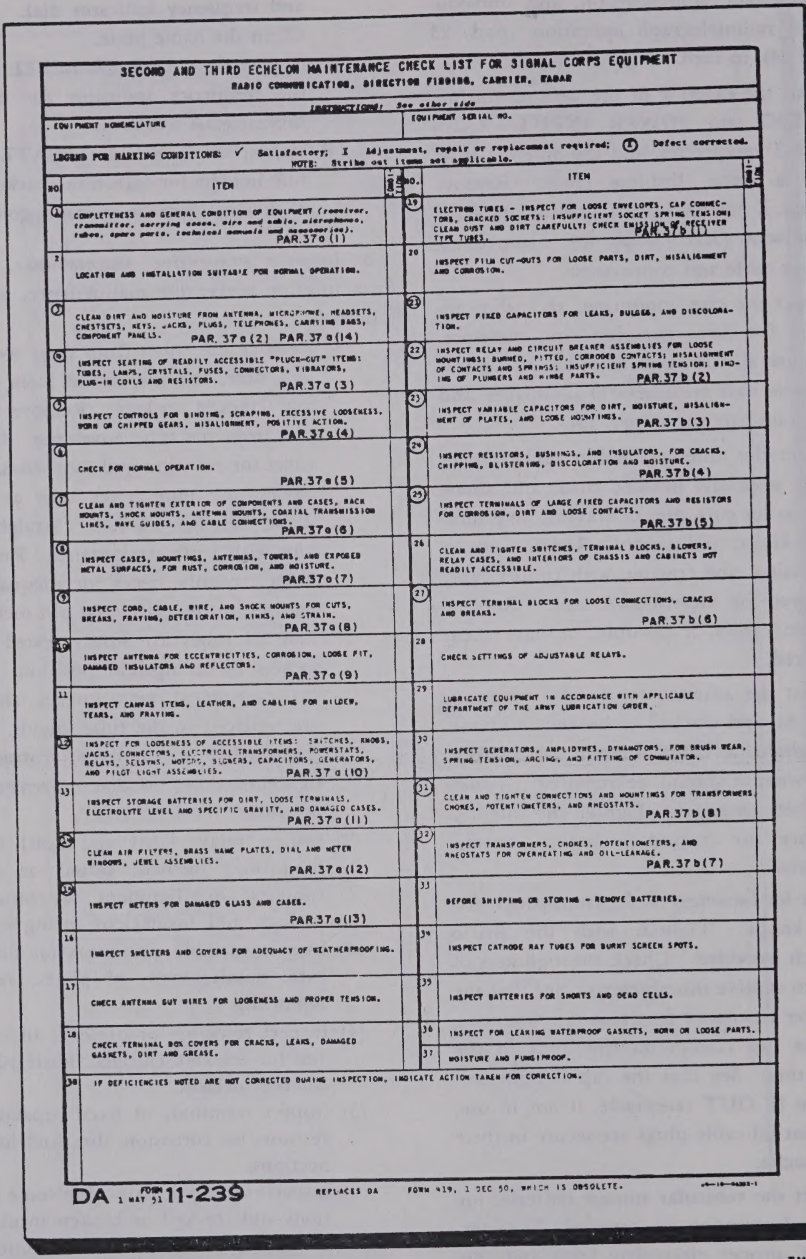
(4) Inspect resistors for presence of moisture, and for cracked, chipped, blistered, or discolored surfaces.

(5) Inspect terminals of fixed capacitors and resistors for corrosion, dirt, and loose connections.

(6) Inspect terminal strips for loose connections and cracked or broken insulation.

(7) Inspect connections and mountings of transformers, chokes, and potentiometers to see that they are clean and secure.

(8) Inspect all connectors to see that they are clean and securely connected.



SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: *See other side*

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; ① Defect corrected.
NOTE: Strike out items not applicable.

NO	ITEM	COND-ITION	NO.	ITEM	COND-ITION
①	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (*receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories*). PAR.37 a (1)		⑲	ELECTRON TUBES – INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS: INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES. PAR.37 b (1)	
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.		20	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.	
③	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 37 a (2) PAR. 37 a (14)		㉑	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION.	
④	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR.37 a (3)		㉒	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS. PAR. 37 b (2)	
⑤	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR.37 a (4)		㉓	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS. PAR.37 b (3)	
⑥	CHECK FOR NORMAL OPERATION. PAR.37 a (5)		㉔	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. PAR.37 b (4)	
⑦	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR.37 a (6)		㉕	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. PAR.37 b (5)	
⑧	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR.37 a (7)		26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE.	
⑨	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 37 a (8)		㉗	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS. PAR.37 b (6)	
⑩	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. PAR. 37 a (9)		28	CHECK SETTINGS OF ADJUSTABLE RELAYS.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.		29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.	
⑫	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR.37 a (10)		30	INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.	
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES. PAR. 37 a (11)		㉛	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS. PAR.37 b (8)	
⑭	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 37 a (12)		㉜	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE. PAR.37 b (7)	
⑮	INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR.37 a (13)		33	BEFORE SHIPPING OR STORING – REMOVE BATTERIES.	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.		34	INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.		35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.	
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.		36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.	
			37	MOISTURE AND FUNGIPROOF.	
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.				

DA FORM 1 MAY 51 11-239 REPLACES DA FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

Figure 21. DA Form 11-239.

modulated radiotelegraph, and unmodulated radiotelegraph operation (pars. 23 and 24), in turn.

(6) Clean the exterior of the case, mounting, AUDIO and POWER INPUT-TRANS CONT receptacles, and the antenna base. Use a clean, lint-free cloth. Remove grease, if necessary, with a cloth dampened in solvent (SD). Wipe dry. Inspect the power cable and connectors.

(7) Inspect the case, mounting, and whip antenna for rust, corrosion, and moisture. Remove all rust spots from mounting and antenna base with #0000 sandpaper and touch up bare spots (par. 35).

(8) Inspect the antenna lead-in cable, power cable assembly, headset cord, and shock mounts for cuts, breaks, fraying, deterioration, kinks, and strain. Repair cuts in insulation, and fraying, with rubber tape, followed by electrician's tape. Replace broken cables, if possible, or have them repaired.

(9) Inspect the antenna for bends, corrosion, loose fit, and cracked or broken insulator. Straighten a bent antenna if possible; otherwise, it should be replaced. Touch up where necessary. Tighten the antenna. Replace any cracked or broken ceramic insulator.

(10) Check for looseness of the front-panel control knobs. Tighten with the Bristo wrench provided. Check the tightness of the ten captive thumbscrews. See that the receiver is secured firmly to the mounting by the two clamps on the front of the mounting. See that the cap is tightened on the IF OUT receptacle, if not in use. See that all cable plugs are secure in their receptacles.

(11) Inspect the vehicular storage batteries for dirt and corrosion on terminals, loose terminals, proper electrolyte level and specific gravity, and damaged cases.

(12) Using a clean, damp cloth, clean the glass windows of the CARRIER LEVEL meter and frequency indicator dial. Wipe dry. Clean the name plate.

(13) Inspect the CARRIER LEVEL meter and the frequency indicator for cracked or broken glass windows.

(14) Inspect the LINE fuse, PLATE fuse, and fuse holders for corrosion, cracks, and lack of sufficient tension to insure good contact.

b. Interior Preventive Maintenance. To perform interior preventive maintenance, proceed as follows:

(1) Remove the tubes from their sockets, one at a time, and inspect for loose envelopes and cracked sockets. Remove dust and dirt from the tube envelopes. Check the tubes for emission and short-circuited electrodes; use tube tester such as Electron Tube Test Set TV-7/U. Straighten tube pins with a pin straightener. Replace the tubes carefully; check for adequate spring tension in the individual pin sockets. See that all tubes are firmly seated in their sockets in an upright position. Be sure that corrugated metal inserts, where used, are replaced in the tube shields, and that the shields are replaced correctly and tightened down so that movement is not possible.

(2) Inspect relays K101 and K601 for loose mounting; burned, pitted or corroded contacts; misalignment of contacts and springs, and insufficient spring tension.

(3) Inspect variable capacitors for dirt, moisture, misalignment of plates, and loose mounting.

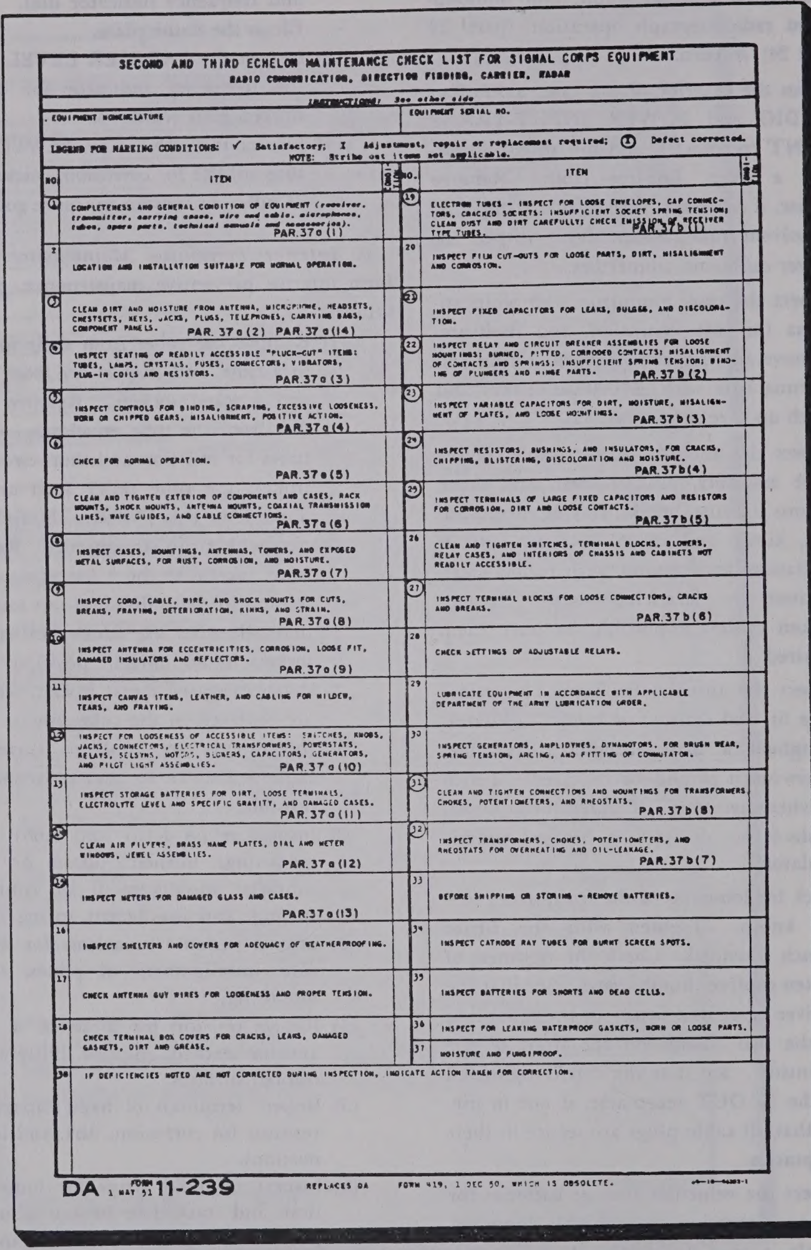
(4) Inspect resistors for presence of moisture, and for cracked, chipped, blistered, or discolored surfaces.

(5) Inspect terminals of fixed capacitors and resistors for corrosion, dirt, and loose connections.

(6) Inspect terminal strips for loose connections and cracked or broken insulation.

(7) Inspect connections and mountings of transformers, chokes, and potentiometers to see that they are clean and secure.

(8) Inspect all connectors to see that they are clean and securely connected.



SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT
RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; I Adjustment, repair or replacement required; Ⓘ Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	CONDITION
①	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (*receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories*). PAR. 37 a (1)	
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.	
③	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 37 a (2) PAR. 37 a (14)	
④	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 37 a (3)	
⑤	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 37 a (4)	
⑥	CHECK FOR NORMAL OPERATION. PAR. 37 a (5)	
⑦	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR. 37 a (6)	
⑧	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR. 37 a (7)	
⑨	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 37 a (8)	
⑩	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. PAR. 37 a (9)	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.	
⑫	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR. 37 a (10)	
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES. PAR. 37 a (11)	
⑭	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 37 a (12)	
⑮	INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR. 37 a (13)	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.	
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.	
⑲	ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS: INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES. PAR. 37 b (1)	
20	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.	
㉑	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION.	
㉒	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS. PAR. 37 b (2)	
㉓	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS. PAR. 37 b (3)	
㉔	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. PAR. 37 b (4)	
㉕	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. PAR. 37 b (5)	
26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE.	
㉗	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS. PAR. 37 b (6)	
28	CHECK SETTINGS OF ADJUSTABLE RELAYS.	
29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.	
30	INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.	
㉛	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS. PAR. 37 b (8)	
㉜	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE. PAR. 37 b (7)	
33	BEFORE SHIPPING OR STORING - REMOVE BATTERIES.	
34	INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.	
35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.	
36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.	
37	MOISTURE AND FUNGIPROOF.	
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.	

DA FORM 1 MAY 51 11-239 REPLACES DA FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM 856-19

Figure 21. DA Form 11-239.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. ORGANIZATIONAL TOOLS AND EQUIPMENT

32. Tools and Materials

The tools and materials contained in Tool Equipment TE-41 (the ordinary hand tools and materials normally available to organizational maintenance personnel) are required for organizational maintenance of Radio Receiver R-392/URR. These tools and materials are listed in Department of the Army Supply Catalog SIG 6-TE-41. In addition, Solvent, Dry Cleaning (SD) (Federal spec No. P-S-661) is required for cleaning purposes.

33. Special Tools Supplied with Radio Receiver R-392/URR

Figure 19 shows the special tools and spare dial-lamp supplied with the receiver. To gain access to the tools on the bottom of the gear cover plate, it is necessary to withdraw the receiver from its case and remove the three Phillips-head screws from the cover plate. Access to the tube pullers mounted on the front of the gear plate can be obtained by removing the receiver from its case. The use of the special tools is described in *a* through *c* below.

a. Tube Pullers. Two cable-grip type tube pullers are furnished; one for 7-pin miniature tubes, and the other for 9-pin miniature tubes. To remove a tube, using one of the tube pullers, slide the puller of the proper size down over the tube envelope. Pull upward on the tool, while wobbling the tube slightly. After the tube has been removed from the socket, remove the tube from the tool by pushing the tube toward the handle.

b. Right-angle Phillips Screwdriver. The No. 8 right-angle Phillips screwdriver is used to loosen or tighten the screws in the front-panel control knobs, the screws securing the subchassis of the receiver to the main frame, and other Phillips head screws within the receiver. It is also used in the disassembly and assembly of the shock mounts of Mounting MT-836/URR.

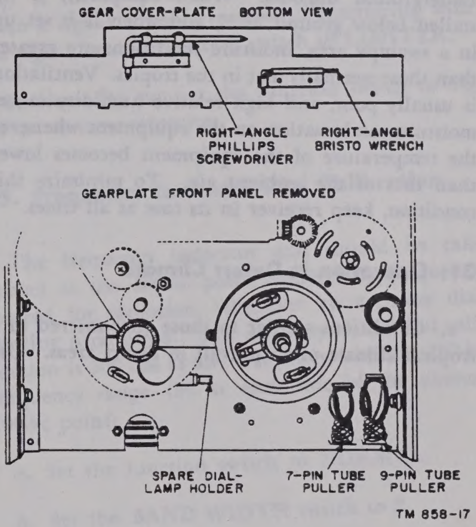

GEAR COVER-PLATE BOTTOM VIEW
RIGHT-ANGLE PHILLIPS SCREWDRIVER
RIGHT-ANGLE BRISTO WRENCH
GEARPLATE FRONT PANEL REMOVED
SPARE DIAL-LAMP HOLDER
7-PIN TUBE PULLER
9-PIN TUBE PULLER
TM 858-17

Figure 19. Special tools.

c. Right-angle Bristo Wrench. The No. 8 right-angle Bristo wrench is used for loosening and tightening the setscrews in the clamps which secure the camshafts and gears in the mechanical tuning system. It is also used in conjunction with the right-angle Phillips screwdriver in the disassembly and assembly of the shock mounts.

d. When the equipment has been exposed to cold and is brought into a warm room, it will sweat until it reaches room temperature. When the equipment has reached room temperature, dry it thoroughly. This condition can also develop when the equipment warms up during the day after exposure during a cold night.

30. Operation in Tropical Climate

When operating in a tropical climate, radio equipment can be installed in tents, huts, or in underground dugouts. When equipment is installed below ground level, and when it is set up in a swampy area, moisture conditions are greater than those normally met in the tropics. Ventilation is usually poor, and high relative humidity causes moisture condensation on the equipment whenever the temperature of the equipment becomes lower than that of the ambient air. To minimize this condition, keep receiver in its case at all times.

31. Operation in Desert Climate

a. Conditions similar to those encountered in a tropical climate often prevail in desert areas. Use the same measures to ensure proper operation of the equipment.

b. The main problem which arises with equipment operated in the desert is the large amount of sand, dust, and dirt which enters moving parts of radio equipment, such as gears and bearings. Because of the immersion-proof feature of the receiver, this problem is of significance only when it becomes necessary to remove the receiver from its case for trouble shooting and repair. When repair is necessary, it should be performed in a shelter which is as dustproof as possible.

c. Never tie power cords, signal cords, or other lines to either the inside or outside of tents. Desert areas are subject to sudden wind squalls which may jerk the connections loose or break the lines.

d. Take care to keep the equipment as free from dust as possible. Pay particular attention to the lubrication of the equipment when it is removed from its case for servicing. Excessive amounts of dust, sand, or dirt, which may enter the receiver when it is taken from the case, coming in contact with oil and grease, will result in damage to the tuning system.

noying when no station or signal is being received proceed as follows:

(1) Set the function switch to SQ.

(2) When no signal is being received, turn the RF GAIN SQUELCH THRESH control slowly to the left (counterclockwise) to the point where the noise is first eliminated in the headset. *Do not turn beyond this point.*

Caution: Do not set the function switch to SQ if the signal is weak or subject to fading. Do not set the function switch to SQ if it is necessary to move the RF GAIN SQUELCH THRESH control more than a small distance to the left (to eliminate the noise in the headset), because the desired station or signal will also be eliminated.

24. Radiotelegraph (CW) and Tone-modulated (MCW) Radiotelegraph Reception

a. Set the function switch to NORMAL.

b. Set the AGC switch to OFF.

c. Set the BAND WIDTH switch to 2.

d. Set the DIAL DIM switch as required.

e. Set the BFO PITCH control to 0.

f. Set the RF GAIN SQUELCH THRESH control to midposition.

g. Set the AF GAIN control to midposition.

h. Set the ANT TRIM control to 0.

i. Set the BFO switch to ON.

j. Unlock the KILOCYCLES control by turning the DIAL LOCK control all the way to the left (maximum counterclockwise).

k. Set the MEGACYCLES and KILOCYCLES controls to the frequency (on frequency indicator dial) of the desired (cw) station or signal (fig. 18).

l. Adjust the KILOCYCLES control to obtain a zero beat in the headset.

m. Adjust the BFO PITCH control to obtain a tone (or code signal) of pleasing pitch in the headset.

n. Adjust the ANT TRIM control so that the tone (or code signals) heard in the headset is at maximum loudness.

o. Adjust the RF GAIN SQUELCH THRESH control so that the tone heard in the headset is loud and *clear.*

p. Adjust the AF GAIN control so that the tone heard in the headset is not too loud or too soft.

q. If the noise or static heard in the headset when a signal is being received is interfering with the signal, set the function switch to LIMITER.

Caution: Do not set the function switch to SQ for cw or mcw reception.

25. Frequency Indicator Dial Calibration

The frequency indicator dial should be calibrated at the 100-kc point nearest the frequency desired for reception, whenever an accurate dial reading is required. The accuracy of the dial calibration is 300 cps at any frequency within a 100-kc frequency range (50 kc each side of the nearest 100-kc point).

a. Set the function switch to NORMAL.

b. Set the BAND WIDTH switch to 2.

c. Set the RF GAIN SQUELCH THRESH control all the way to the right (maximum clockwise).

d. Set the AF GAIN control to midposition.

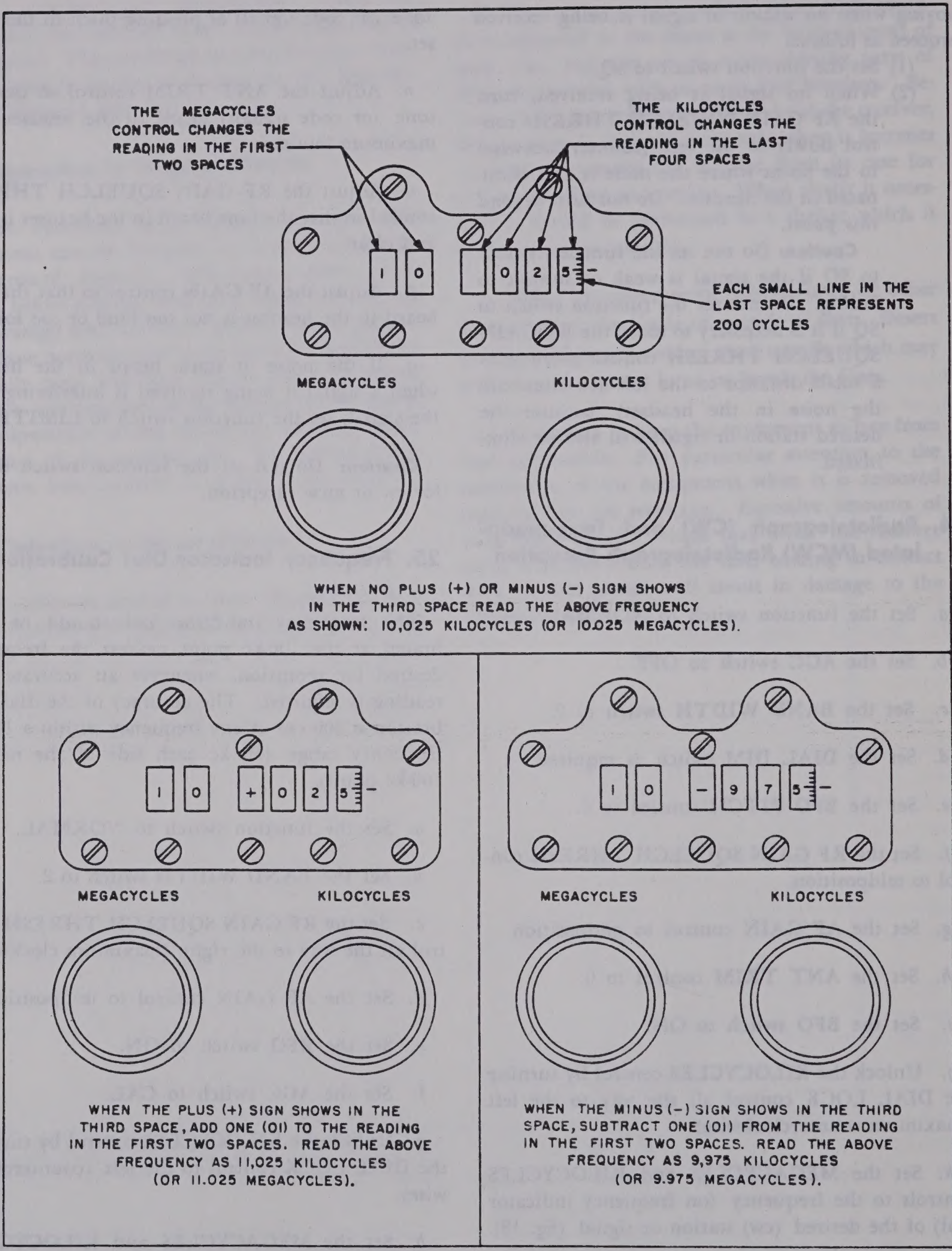
e. Set the BFO switch to ON.

f. Set the AGC switch to CAL.

g. Unlock the KILOCYCLES control by turning the DIAL LOCK control to the left (counterclockwise).

h. Set the MEGACYCLES and KILOCYCLES controls to a reading on the frequency indicator dial at the 100-kc point nearest the frequency desired for reception.

Example: If the frequency of the desired


THE MEGACYCLES CONTROL CHANGES THE READING IN THE FIRST TWO SPACES
THE KILOCYCLES CONTROL CHANGES THE READING IN THE LAST FOUR SPACES
EACH SMALL LINE IN THE LAST SPACE REPRESENTS 200 CYCLES
1 0 0 2 5
MEGACYCLES
KILOCYCLES
1 0 + 0 2 5
MEGACYCLES
KILOCYCLES
1 0 − 9 7 5
MEGACYCLES
KILOCYCLES

WHEN NO PLUS (+) OR MINUS (−) SIGN SHOWS IN THE THIRD SPACE READ THE ABOVE FREQUENCY AS SHOWN: 10,025 KILOCYCLES (OR 10.025 MEGACYCLES).

WHEN THE PLUS (+) SIGN SHOWS IN THE THIRD SPACE, ADD ONE (01) TO THE READING IN THE FIRST TWO SPACES. READ THE ABOVE FREQUENCY AS 11,025 KILOCYCLES (OR 11.025 MEGACYCLES).

WHEN THE MINUS (−) SIGN SHOWS IN THE THIRD SPACE, SUBTRACT ONE (01) FROM THE READING IN THE FIRST TWO SPACES. READ THE ABOVE FREQUENCY AS 9,975 KILOCYCLES (OR 9.975 MEGACYCLES).

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Figure 18. Frequency indicator dial readings.

Control or switch	Position	
	AM reception (voice)	CW or MCW reception (radiotelegraph or modulated-tone radiotelegraph)
Function switch	**OFF**	**OFF**
AGC switch	**ON**	**OFF**
BAND WIDTH switch	**8**	**2**
BFO switch	**OFF**	ON
AF GAIN control	**Midposition**	Midposition
RF GAIN SQUELCH THRESH	**All the way to the right (maximum clockwise)**	All the way to the right (maximum clockwise)
DIAL DIM switch	As required	As required
ANT TRIM control	0	0
BFO PITCH control	0	0
DIAL LOCK	Maximum clockwise (to the right)	Maximum clockwise (to the right)

b. Starting. Turn receiver on by setting function switch to NORMAL. If the receiver is not to be used immediately, turn the function switch to STAND BY. Connect a headset to an AUDIO receptacle of the receiver. Allow receiver to warm up (keep the function switch at STAND BY) for 5 minutes before using.

23. Voice (AM) Reception

a. Set function switch to NORMAL.

b. Set the AGC switch to ON.

c. Set the BAND WIDTH switch to 8.

d. Set the ANT TRIM control to 0.

e. Set the BFO switch to OFF.

f. Set the DIAL DIM switch as required.

g. Set the AF GAIN control to midposition.

h. Set the RF GAIN SQUELCH THRESH control all the way to the right (maximum clockwise).

i. Unlock the KILOCYCLES control by turning the DIAL LOCK control all the way to the left (maximum counterclockwise).

j. Set the MEGACYCLES and KILOCYCLES controls to the reading on frequency indicator dial of the desired station or signal (fig. 18).

k. If the station or signal is being received, a voice or tone should be heard in the headset. The CARRIER LEVEL meter may or may not show a reading.

(1) *For strong stations or signals, when a reading is noted on the CARRIER LEVEL meter,* first adjust the KILOCYCLES control and then adjust the ANT TRIM control to obtain a maximum (peak) reading on the CARRIER LEVEL meter.

(2) *For weak stations or signals, when there is no reading on the CARRIER LEVEL meter,* first adjust the KILOCYCLES control and then adjust the ANT TRIM control so that the voice or tone heard in the headset is at maximum loudness.

l. Lock the KILOCYCLES control by turning the DIAL LOCK control all the way to the right (clockwise).

m. Adjust the AF GAIN control so that the voice or tone heard in the headset is not too loud or too soft.

n. If objectionable static is heard in the headset when a voice or tone is received, set the function switch to LIMITER.

o. If interference from another station or signal is heard in the headset when a voice or tone is received, set the BAND WIDTH switch to 4KC, or if necessary, to 2.

p. If the noise heard in the headset is very an-

21. Radio Receiver R-392/URR Controls (cont)

(fig. 17)

<table>
<tr><th>Control or switch position</th><th>Function or use</th></tr>
<tr><td>AUDIO receptacles (J101 and J102)</td><td>Used to connect a headset or speaker to the receiver. Either or both receptacles can be used. Used to connect a microphone or key to the receiver when the receiver is used as part of Radio Set AN/GRC-19. The receptacle pins and circuits to which they are connected are listed below:
<table>
<tr><th><i>Pin</i></th><th><i>Circuit</i></th></tr>
<tr><td>A and L</td><td>Af output</td></tr>
<tr><td>B, E, and H</td><td>Ground</td></tr>
<tr><td>C</td><td>Microphone</td></tr>
<tr><td>D and J</td><td>No connection</td></tr>
<tr><td>F</td><td>Push-to-talk switch on microphone or key</td></tr>
<tr><td>K</td><td>Carrier (relay) control</td></tr>
</table></td></tr>
<tr><td>POWER INPUT-TRANS CONT (transmitter control) receptacle (J103)</td><td>Used to connect the receiver to the power input from the vehicular electrical system. Used to connect the receiver to an associated transmitter such as Radio Transmitter T-195/GRC-19 for power and control, when used as part of Radio Set AN/GRC-19. The receptacle pins and circuits to which they are connected are listed below.
<table>
<tr><th><i>Pin</i></th><th><i>Circuit</i></th></tr>
<tr><td>A</td><td>28-volt B+ (positive voltage)</td></tr>
<tr><td>B</td><td>Break-in relay control</td></tr>
<tr><td>C</td><td>Microphone</td></tr>
<tr><td>D</td><td>28-volt filament (positive voltage)</td></tr>
<tr><td>E</td><td>Ground</td></tr>
<tr><td>F</td><td>Push-to-talk switch on microphone or key</td></tr>
<tr><td>H</td><td>Af output</td></tr>
<tr><td>J</td><td>No connection</td></tr>
<tr><td>K</td><td>Carrier (relay) control</td></tr>
</table></td></tr>
</table>

Section III. OPERATION UNDER USUAL CONDITIONS

22. Starting Procedure

a. General. Set the front-panel controls as shown in the following table. *This section is to be referred to only when the receiver is used by itself and not as part of Radio Set AN/GRC-19. When the receiver is used as part of Radio Set AN/GRC-19 refer to the instruction book on Radio Set AN/GRC-19.*

19. Service Upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions in paragraph 15 for uncrating, unpacking, and inspecting the equipment.

b. Examine the used or reconditioned equipment for tags or other indications pertaining to changes in the wiring of the equipment. If any changes in the wiring have been made, note the change in this instruction book, preferably on the schematic diagrams.

c. Check the MEGACYCLES and KILOCYCLES control knobs for ease of rotation. If lubrication is required, refer to the lubrication instructions in paragraphs 109 and 110.

d. Perform the installation and connection procedures given in paragraphs 16, 17, and 18.

Section II. CONTROLS AND INSTRUMENTS

20. General

Haphazard operation or improper setting of the controls can cause damage to electronic equipment. For this reason, it is important to know the function of every control. The actual operation of the equipment is discussed in the next section of this instruction book.

21. Radio Receiver R-392/URR Controls
(fig. 17)

The controls and switch positions of the receiver are listed in the table below. *When the receiver is used as part of Radio Set AN/GRC-19 refer to the instruction book on Radio Set AN/GRC-19.*

Control or switch position	Function or use
Function switch (S104) (located to the right of the CARRIER LEVEL meter)	
Positions	
OFF	Disconnects the power input to the receiver. The receiver is turned off.
STAND BY	Connects power input to the filaments of the vacuum tubes in the receiver, but a station or signal cannot be received. When the function switch is turned to NORMAL, LIMITER, or NET, the receiver, if tuned-in properly, can receive a station or signal immediately.
LIMITER	Connects a noise limiter circuit in the receiver, which reduces the static or noise heard in the headset when a station or signal is being received. Static is not completely eliminated. On strong signals the static will be reduced. On weak signals, the LIMITER circuit has little effect on static.
Positions	
NORMAL	Connects the receiver for normal operation. The switch is set to NORMAL when the noise heard in the headset is not objectionable during reception of a station or a signal.
NET	Disconnects an antenna grounding relay circuit in the receiver, which permits simultaneous operation of the receiver and an associated transmitter such as Radio Transmitter T-195/GRC-19 when used as part of Radio Set AN/GRC-19.
SQ (squelch)	Connects a squelch circuit in the receiver, which prevents noise from being heard in the headset when a station or signal is not being received or when the signal strength is below a signal input level (threshold value)

18. Connections
(fig. 16)

a. Antenna. To attach the antenna lead-in to the mast base, twist the end of the wire lead-in and attach it to the binding post on the bottom of the base. Attach the other end of the lead-in to the ANT binding post on the receiver, which is the lower of the two ANT connectors.

b. Power. Use Electrical Special Purpose Cable Assembly CX-1597/U to connect the receiver to the 24-volt dc, vehicular electrical system. Connect the black center conductor of the power cable assembly to the positive terminal of the electrical system and connect the braided shield to the negative terminal (ground).

c. Headset or Speaker. If Headset Navy Type CW-49507 is used, plug the headset into Audio Headset Cord CX-1334/U, and connect the headset cord to one of the AUDIO receptacles on the receiver front panel. In the event that Dynamic Loudspeaker LS-166/U is used instead of a headset, connect the speaker directly to one of the AUDIO receptacles. When a 600-ohm headset or speaker other than those mentioned above is employed, use an Amphenol type 164-8 plug to connect the headset or speaker cord to the AUDIO receptacles. The conductors of the cord are connected to contact A or L and to (ground) contact B, E, or H of the connector.

d. Radioteletype, Frequency-shift Converter. When the receiver is used for single-channel, frequency-shift radioteletype operation, connect a radioteletype frequency-shift converter to the IF OUT receptacle on the receiver front panel; use the cable supplied with the converter.

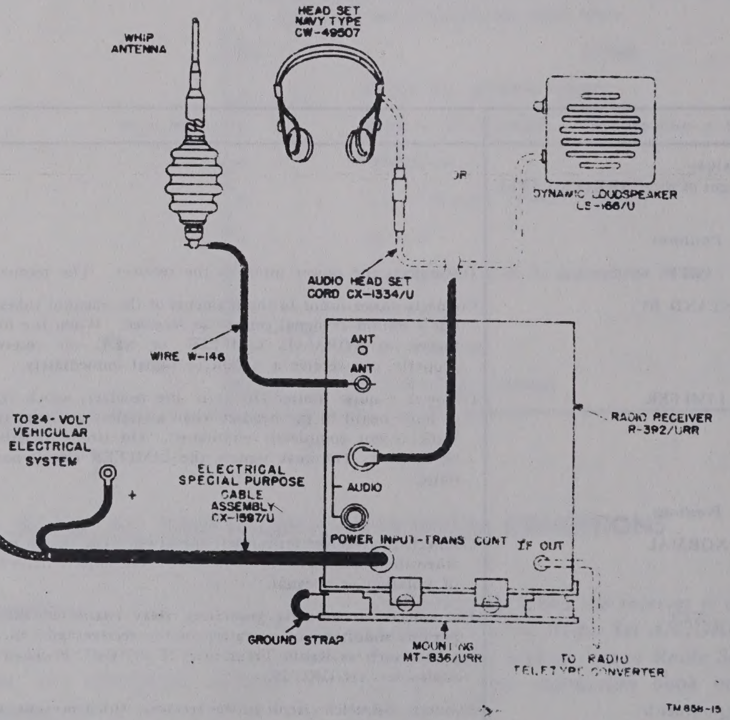
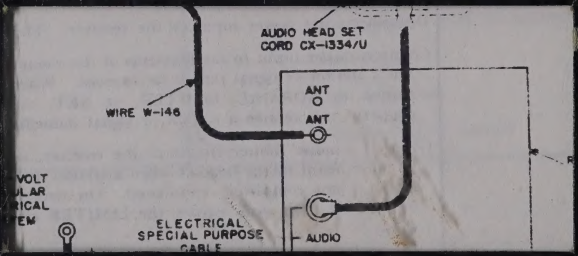

HEAD SET NAVY TYPE CW-49507
WHIP ANTENNA
OR
DYNAMIC LOUDSPEAKER LS-166/U
AUDIO HEAD SET CORD CX-1334/U
ANT
ANT
WIRE W-146
RADIO RECEIVER R-392/URR
TO 24-VOLT VEHICULAR ELECTRICAL SYSTEM
-
+
ELECTRICAL SPECIAL PURPOSE CABLE ASSEMBLY CX-1597/U
AUDIO
POWER INPUT-TRANS CONT
IF OUT
GROUND STRAP
MOUNTING MT-836/URR
TO RADIO TELETYPE CONVERTER
TM 858-15

Figure 16. Radio Receiver R-392/URR, cording diagram.


AUDIO HEAD SET
CORD CX-1334/U
WIRE W-146
ANT
ANT
-VOLT
ULAR
RICAL
TEM
ELECTRICAL
SPECIAL PURPOSE
CABLE
AUDIO
R